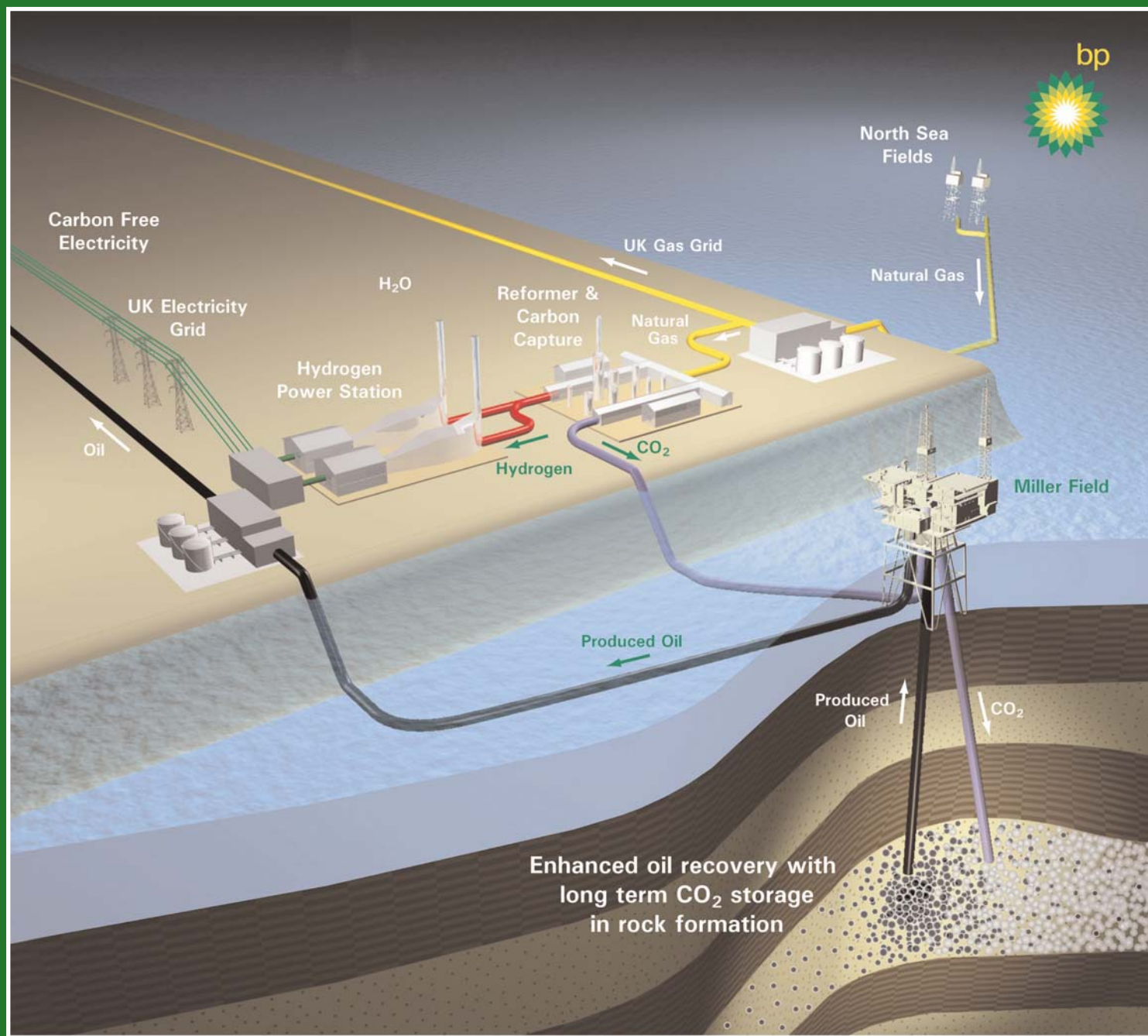


Summer 2006



SCIENCE IN PARLIAMENT



Low Carbon Power with Carbon Capture and Sequestration

Sustainable Energy

Expert Witnesses

SCIENCE IN PARLIAMENT

The Journal of the Parliamentary and Scientific Committee.

The Committee is an Associate Parliamentary Group of members of both Houses of Parliament and British members of the European Parliament, representatives of scientific and technical institutions, industrial organisations and universities.

Science in Parliament has two main objectives:
a) to inform the scientific and industrial communities
of activities within Parliament of a scientific nature
and of the progress of relevant legislation;
b) to keep Members of Parliament abreast
of scientific affairs.



The University of Sussex has decided to maintain its Chemistry Department, albeit with an emphasis on "biological chemistry". At Exeter, another Vice-Chancellor Smith has announced that, although a decision to close the Chemistry Department and downsize RAE 4-rated departments will cost money in the short term, the long-term prospects for the university are looking better as a result. But, what about the country?



Speculation that the last RAE was just that has proved wrong. About a third of Vice-Chancellors would welcome a new approach; the rest feel that they have invested too much already in preparing for the 2008 RAE.

"Metrics" is the new fashion but clearly more work needs to be done to convince the academic community to invest in this new methodology.

The Government's Chief Scientific Adviser, Sir David King, has never been afraid of expressing his views. On climate change he has expressed the view that it is "more serious even than the threat of terrorism". In this edition of *Science in Parliament* Robert Freer reviews a House of Lords report entitled "Economics of Climate Change", which challenges some conventional views. Sir David has now waded into the debate on "mind bending" drugs. He predicts that smart drugs that affect people's performance will be commonplace within 20 years. A new generation of "recreational psychoactive substances" could be given to healthy people to enhance their lives. His new report certainly challenges conventional thinking, and will make the Government nervous.

The House of Commons Science & Technology Select Committee has just announced an inquiry into the use of science to enhance human performance, particularly in sport.

PPARC and CCLRC have decided to endorse the formation of a Large Facilities Council providing that PPARC's grant-awarding powers are transferred to the LFC and not to the EPSRC, a proposal that is meeting with some resistance within the research community.

Dr Brian Iddon MP
Chairman, Editorial Board
Science in Parliament

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ISSN 0263-6271

Energy Policy

Dr Bob Spink MP

Energy policy is a hot topic. On one hand, there is concern over the threats to energy security posed by our growing reliance on gas imported from politically unstable parts of the world. On the other, science is painting an ever-bleaker picture of the likely consequences of CO₂-fuelled global climate change.

Add to these the fast rising cost of energy to industry and the consumer, particularly to less well off people who are forced to pay an unsustainable proportion of their income on essential energy, and it is easy to see why many believe the problem is fast becoming a crisis.

Against this background, the Government's wholesale review of energy policy seems eminently sensible. However, the challenges addressed in the current Energy Review are the same as those of the 2003 Energy White Paper, only infused with a greater sense of urgency. The truncated time allowed for the review has also fuelled accusations that the Government launched the review with a clear idea of what it wanted the outcome to be. After all, it wouldn't be the first time that the Government has dressed up a process of ratification as a consultation.

The Prime Minister now confirms these suspicions by strongly indicating that the review must herald a new cycle of investment in nuclear power. It is clearly unhelpful of the PM to undermine the review by pre-judging its conclusions. But that said, he is right that nuclear has to form a key plank of the UK's energy policy. Without new nuclear build, it is inconceivable that we will be able to meet our CO₂ emissions targets and safeguard our security of supply. In any case, many of the old objections to nuclear power have been eroded by safety and efficiency improvements with new reactor technology. Although it is true that

safe, flexible and politically acceptable solutions need to be found for radioactive waste management, modern reactors would produce far less waste than our current fleet.

Investment in nuclear fission needs to be accompanied by investment in new technologies. Nuclear fusion, for example, could revolutionise energy production by providing a clean, safe and sustainable means of generating energy. It is uncertain when or if fusion will deliver on its promises, but the prize on offer is too significant to be ignored and, now that the site of ITER has finally been decided, the UK needs to work with its international partners to get the project off the ground.

CCS is another exciting technology. It involves the capture of CO₂ produced during industrial processes and its long term storage, possibly by injection into underground reservoirs, thus preventing the CO₂ from entering the atmosphere. It is argued that CCS technology will divert attention from developing renewable sources of energy and encourage continued dependence on fossil fuels. Clearly the ability to harness solar and tidal power on a large scale would be invaluable and the Government must continue to invest in such research. Also promoting energy efficiency and conservation are vital first steps, not afterthoughts. But we need to accept that we are not yet ready to wean ourselves off fossil fuels and, that being the case, CCS could be a crucial bridging technology.

It is worth noting as well that the first UK fossil fuel plant fitted with CCS could be generating low-carbon electricity by the end of the decade, with a single plant giving reductions in CO₂ emissions of the same scale as all the current UK onshore wind farms put together. The Government should move quickly to amend regulations and



promote and invest in large scale demonstration CCS projects.

The House of Commons Science and Technology Committee, of which I am a Member, published a report on carbon capture and storage technology (CCS) in February this year. We concluded that not only could CCS play a key role in the UK's energy portfolio in years to come, it could also provide a much needed tool for curbing the massive growth in CO₂ emissions expected from new coal-fired plant in India and China. This is crucial to our planet since the growth in emissions from China alone over the next twenty years is forecast to match that in the entire industrialised world. CCS could also help to safeguard security of supply by allowing the UK to continue using a greater diversity of fuels sourced from a variety of countries, and cost would be mitigated by enhanced oil recovery from reservoirs.

Setting aside for a moment the health of the planet and UK economic opportunity from selling CCS technology, we are a relatively industrialised nation and have a clear moral duty to show leadership to developing economies.

The Government urgently needs to put in place a market-based and technology neutral framework focused on reducing CO₂ emissions in order to pull through the development of innovative solutions to meet the UK's energy needs. The Energy Review provides the perfect opportunity for the Government to achieve this as part of the long-term strategic vision that has been seriously lacking from its energy policy thus far.

Climate change in earth history: policy implications

Deep time context

As we wait to see how climate will evolve over the next century, we may increasingly draw lessons from the climate of Earth's deep past. Thus, human civilization has been allowed to develop to its present extent because the last ten thousand years – when set against the context of the last million years – have seen unusual stability of climate and sea level. That situation looks set to change.

It is beyond doubt that earth's climate over the last few million years has been controlled by variations in the earth's spin around its own axis and orbit around the sun, operating on cycles tens of thousands of years long. It is also clear that the climate changes have not smoothly followed these cycles, but have shown abrupt (decade-scale) flips from one climate state to the other, and that these have been associated with changes in atmospheric levels of carbon dioxide and methane, as recorded in air fossilized within the icecaps of Greenland and Antarctica. The situation is further complicated by shorter-term (millennial-scale) climate variations, the causes of which remain poorly understood.

The human effect

The contribution of humanity since the Industrial Revolution has been to cause the largest single and most abrupt perturbation to these global geological cycles for several million years. The scale of this change has led some scientists to suggest, with all seriousness, that we have entered a new geological epoch, christened the Anthropocene.

Of all of these man-made changes, the most far-reaching is likely to be

the several hundred billions of tons of carbon transferred from terrestrial reservoirs to the atmosphere, over an exceptionally short time: less than 200 years. This release is unprecedented in the context of recent earth history, not least because it is happening during a warm phase of the current Ice Age.

Fossilized global warming events

Recent research has shown, though, that there have been precedents for such carbon releases farther back in earth history. The two best-known episodes occurred some 55 and 180 million years ago respectively, when carbon transfers on a similar scale (probably derived from the decomposition of methane hydrates stored in ocean sediments) were associated with geologically rapid global temperature rises of between 5 and 8 degrees centigrade, that persisted for the order of 100,000 years.

Such temperature increases, if repeated in the near future, would almost certainly lead to melting of a substantial part of the global icecaps, and the subsequent sea level changes of tens of metres, in removing a large fraction of the earth's arable land, would render unsustainable earth's current global population, let alone the extra 2-4 billion people predicted for the coming century. Research published this year has confirmed that the Greenland and Antarctica icecaps are showing considerable overall ice loss – measured in hundreds of cubic kilometres annually. There is now serious concern that such ice loss might accelerate markedly in the future¹.

Policy implications

What are the policy implications? It is clear to us that:

Further research into these and related phenomena are imperative, not to establish their reality (which are beyond reasonable doubt), but to constrain further the exact mechanisms involved and their timing.

The clear dangers of global warming are not currently being matched by adequate funding of either mitigation or adaptation strategies, nor by overall economic strategy. For instance, funding for carbon sequestration is counted in terms of millions of pounds, while funding for (say) identity cards or health service computer systems is counted in billions. This is not to decry the latter, but simply to provide some comparison of perceived relative importance. Similarly, the continued lack of fiscal constraints on aviation sends a strong message to the public that economic growth and cheap air transport are more important than reducing the carbon dioxide emissions from this source.

We note the mismatch between the rigour of the current health and safety regulations that increasingly govern our lives (even where minimal risk is involved) and the apparent negligence of the health and safety of our children and grandchildren, given the probability that the lives of many will be curtailed by lack of nourishment, living space or civil order, brought on by climate change. We urge consideration of, and action on, these matters.

The Stratigraphy Commission of the Geological Society of London

Dr Jan Zalasiewicz (Chair: University of Leicester), Dr Alan Smith (University of Cambridge), Dr Colin Waters (Secretary: British Geological Survey), Dr F John Gregory (Publications Secretary; Natural History Museum), Dr Tiffany L Barry (Open University), Dr Paul R Bown (University College London), Professor Patrick Brenchley (University of Liverpool), Dr Angela L Coe (Open University), Professor John CW Cope, Dr Robert Knox (British Geological Survey), Professor Andrew Gale (University of Greenwich), Professor Philip Gibbard (University of Cambridge), Dr Mark Hounslow (University of Lancaster), Dr John Marshall (University of Southampton), Dr John Powell (British Geological Survey), Dr Michael Oates (British Gas), Dr Philip Stone (British Geological Survey), Professor Peter Rawson (University College London), Dr Nigel Trewin (University of Aberdeen), Dr Mark Williams (University of Portsmouth).

¹ The March 24th 2006 issue of Science includes several remarkable articles detailing the history and current health of the world's icecaps.

OPINION

Baroness Greenfield
Director, The Royal Institution

Technology has been having a profound and widespread impact upon the very nature of society for a long time. Fifty years ago videotapes, bar codes and oral contraceptives were invented, one hundred years ago Marconi sent the first radio message and a hundred years before that the steam locomotive, tin cans and the first electric lamp (the arc lamp, invented by Humphry Davy, a predecessor of mine at the Royal Institution) were introduced. We can go back almost a millennium and find the introduction of technologies such as paper money, the compass, gunpowder and windmills, not to mention buttons. Today, the rate of introduction of technologies is ever increasing and changing the way that we work, play and live our lives. This is no more evident than in learning and education. Technology had a limited impact within education for many years but more recently the changes have started to come thick and fast. As Ken Boston, Chief Executive of the Qualifications and Curriculum Authority, said last year “The availability of the internet is a powerful aid to learning but carries a new generation of risks of plagiarism” and his admission that downloading essays from the internet “could not be controlled” raises some serious issues.

I have no doubt that these issues will be dealt with effectively; but what gives me wider cause for concern is that the risks associated with the introduction of any technologies, particularly in information and communications

technologies are rarely considered before the technology is adopted or comes into being.

The arguments made for the introduction for the majority of technologies are convincing and I am passionate about innovation and creativity in learning, but with the opportunities and promise there are potential drawbacks which are not always fully considered nor necessarily immediately apparent. Recently, I sponsored a debate in the House of Lords on this issue which received some media coverage (http://www.futuremind.ox.ac.uk/sub_site/news.php) which in turn prompted numerous teachers and parents to get in touch with me, sharing their concerns on this issue.

There is doubt amongst the minds of many that while computers and associated technologies increase the motivation of students, do they really improve the learning outcomes? Of course, another level of complexity is added when we start to think about what we will want those learning outcomes to be. Twenty-first century technology should be helping to deliver twenty-first century learning. An understanding of the underlying processes in the brain that contribute to learning can not answer questions about what the future of learning should look like, but it can certainly inform what it could look like.

In the Autumn, a number of parliamentary colleagues, including Baroness Morris of Yardley and Baroness Shephard of Northwold, Baroness Williams of Crosby, Phil



Willis MP and I, will set up an all party group on scientific research in learning and education. In particular, we will consider how a scientific evidence-base may be used to help inform decision making and policy in learning and education, and in this period of evolution and revolution for education, to help ensure that navigation of our chosen path draws at all times from thoughtful use of innovative technologies and the best of twenty-first century teaching.

No previous generation of educators have had as much knowledge at their fingertips as to how the brain works as we have. It therefore falls to us to consider how we meet the needs of children and, using that knowledge, to make sure that we can teach in a way that will enable every child to reach his or her potential. Today, young minds are developing under influences of unparalleled magnitude such as the use of prescribed and proscribed drugs, information technology and the devices it enables, the prospect of direct brain-computer interfacing, and changes in nutrition.

Now is the time to consider how we might harness the opportunities created by new technologies to maximise the potential of each individual whilst managing the risks and safeguarding our young people against harm.

With thanks to Dr Martin Westwell at the Institute for the Future of the Mind (www.futuremind.ox.ac.uk)

A Mission for Innovation – Fostering science enquiry learning across the UK

Jonathan Kestenbaum

Chief Executive, National Endowment for Science, Technology and the Arts (Nesta).



Thankfully, Sussex University's chemistry department has now been saved from closure, but this long-running saga saw a number of rationales put forward for its potential demise: a lack of funding from central government; a lack of will from the university itself; and, most notably, a lack of students. Despite figures suggesting that chemistry applications to the university had actually risen over the previous two years, there is little doubt that the problem was informed by the more general lack of interest our school leavers have in taking degrees in this subject. Indeed, the parliamentary committee which looked into the Sussex affair made one particularly apposite point in amongst its conclusions, namely that the declining interest in chemistry amongst the young was "without doubt a national concern". In an international economy, where a nation's capacity for innovation, science and technology is increasingly key to its ability to compete, we should all be concerned that school pupils no longer wish to study chemistry at undergraduate level.

This disinterest is, sadly, not merely

applicable to chemistry, but found across all the sciences, and it is a worrying trend. Our scientific research base and public scientific literacy depend on a strong foundation at school level, yet increasingly this foundation appears to be slipping. We have already seen our manufacturing base usurped by the economies of India and China, and, as a nation, we must guard against the very real possibility that our science and technology-based markets could soon suffer the same fate. There is no shortage of motivated, dynamic young undergraduates pouring into Indian and Chinese universities and then emerging to transform the innovation capabilities of those countries. Yet here in the UK, where our innovation potential is vast yet still relatively untapped, the numbers appear to be drying up.

At Nesta, the National Endowment for Science, Technology and the Arts, our aim is to transform the UK's capacity for innovation in the firm belief that this leads to long term social and economic benefits. With endowed finance of £300m, we are the largest single source of pre-revenue investment in the UK. We also invest in projects across the

entire innovation landscape to improve entrepreneurship and creativity, and undertake research aimed at influencing key policy-makers. It was under this policy and research remit that we recently produced a wide-ranging study focusing on how the manner in which children are taught science affects their learning. It concluded that pupils are losing interest in science because too often the subject is being taught as just facts on a board, rather than being shown as both relevant to daily life and a glorious exploration of the unknown through practical experimentation. Conducting practical science experiments, which may be termed as science enquiry learning, is an engaging manner of education which involves and motivates learners, and, most importantly, encourages school children to consider taking this interest on to undergraduate level. Regretfully, however, it is no longer the norm in our schools because of the constraints faced by teachers. Put another way, lessons are now too much based around books and not enough around Bunsen burners. So why, specifically, is it that a reliance on the more "traditional"

forms of science teaching still seem to prevail? Alongside the research, a Nesta-commissioned ICM poll found that science teachers had little doubt about the value of science enquiry learning, but that many still had misgivings about allowing pupils the chance to undertake practical experiments. The poll, answered by 500 secondary school teachers across the UK, found that 84% considered science enquiry learning to be very important – with 87% agreeing that it can have a significant impact on pupils' performance – but that 64% found themselves curtailed by a lack of time and resources. An astonishing 87% also said that they had at least once prevented their students from undertaking practical work because they believed current health and safety regulations prohibit them from doing so. A recent survey commissioned by the Royal Society of Chemistry has echoed these findings.

So how can this apathy towards the sciences be dealt with before the economic consequences impact on the UK in ten or twenty years' time? At national policy level there needs to be greater recognition of the consequences outlined above: that if today's children lose out on the opportunity to engage with science in an illuminating manner, then tomorrow's society will suffer as a result of the UK's stuttering scientific public literacy and stunted capacity for research. The current National Curriculum is not so inflexible that there exists no opportunity for science enquiry learning within it, and, at government level, more must be done to encourage schools and teachers to exercise this leeway to provide innovative methods of teaching. Scientific literacy needs to take its place alongside general literacy and numeracy as a major part of the agenda to raise standards in our schools.

Yet, as noted above, it is unfair to suggest that it is teachers themselves who are unaware of the importance

of science enquiry, but rather that they believe that the curriculum and, more presciently, health and safety legislation, inhibits them from allowing children to undertake practical learning. Again, it must be the remit of those in government to assuage the anxiety of teachers and quash the unfounded fears of litigation attached to science enquiry learning. Teachers themselves, where successful outcomes are derived from particular models, must attempt to form knowledge-sharing networks with other schools and professional bodies. They must further seek to install the key elements of effective practice in science enquiry learning, such as dedicated project managers, making links to topics beyond the traditional science curriculum and securing the commitment of senior management within schools. This can, of course, only be achieved through the assistance of funding and support organisations, such as Nesta, who must seek to enhance this transfer of professional knowledge of innovations in science education, and ensure that such schemes have their outcomes and impacts properly evaluated. Inevitably, the sustainability of innovative projects must be insured through improved funding. So far, Nesta's investment has been significant: over £1.6 million for projects promoting science in schools in addition to £3.5 million for schemes supporting the public appreciation of science.

While it is imperative that science enquiry learning is given far greater prominence in our classrooms and school laboratories, there is, of course, much still to be done at the other end of the university spectrum. As chief executive of Nesta, I will continue to champion the case for business learning and the creation of networks between companies, students and universities, however sterile this debate may have become over recent months. We still lag considerably behind the

Scandinavian countries and the US in terms of the exposure to business culture we offer our aspiring undergraduate scientists and technicians. During a recent trip to both these regions, I was able to see at first hand how business and academia are integrated to a far greater degree than is found in the UK. Nokia's acceptance of science students into its company for large periods of their degrees incubates business acumen within them. Similarly, the establishment of new science degree masters courses incorporating elements of business learning in over 50 US universities is similarly typical of the American acceptance that scientific and business creativity are not diametrically opposed opposites. Too often in the UK the misconception prevails that science and business leaders do not share the same characteristics. Yet a zeal for creativity and the capacity for subversive thought when confronted with seemingly implacable norms are attributes shared by those who prosper in both these fields.

It is time for politicians of all parties to recognise that the UK simply cannot afford to maintain a culture of apathy towards science and technology. The present government has improved the UK's focus in this area as well as boosting public funding; similarly I was pleased to note the recent establishment of the Conservatives' Science, Technology, Engineering and Mathematics Taskforce. The landscape for innovation in the UK, however, will only be revamped if a more general consensus can be formed across the entire political spectrum. All political parties must work towards a national mission for science to ensure creative innovation is stimulated instead of stifled. If they do not, the result will be not just the closure of university science departments across the country, but the strangulation of the UK economy for decades to come.

The Defence Science and Technology Laboratory

*Dr Frances Saunders
Acting Chief Executive, Dstl*



Introduction

The Defence Science and Technology Laboratory (Dstl) is an integral part of the Ministry of Defence (MOD) and was created in 2001 to be the trusted in-house adviser on defence-related science and technology. Dstl employs some 3000 scientists and engineers and currently stands at number 76 in the Times Top 100 of graduate employers. Committed to the highest standards and scientific excellence, Dstl offers its staff a comprehensive programme of continuing professional development and is well known in the wider community for promoting both science and scientific careers. Dstl's remit is to create the winning edge for UK Forces and government through the best use of science and technology. In so doing, Dstl's expertise is used to undertake work that must be done in government and does not undertake those things that can sensibly be sourced from industry or academia. Dstl's key strength is its breadth of understanding of science and technology coupled with a clear comprehension of the defence user context. This enables Dstl to bring together solutions to the really difficult and high impact problems that really address the user's needs. Dstl continues to evolve to reflect the changing nature of warfare and the emerging concerns of its customer base. This is leading to requirements for a different balance of skills, knowledge and techniques from that of its predecessor organisations. Large-scale, high-intensity conflicts planned against long time-scales have been replaced by a wide variety of almost continuous, demanding operations typified by the recent conflicts in Bosnia, Afghanistan and Iraq. The blurring of the boundary between defence and security is increasing the requirement to counter the

asymmetric threat as well as support the fight against global terrorism. These changes, in turn, demand a more immediate and responsive pull-through of science and engineering, and a greater engagement in and support for front line operations.

In order to ensure that Dstl responds effectively to these changes, it offers a range of products and services to its users. These fall into two broad categories. Dstl's Systems work develops and assesses new operational and equipment concepts as well as providing the evidence base for major decisions. Dstl's work in the science and technology area is concerned with delivering practical solutions to defence and security related problems in areas of particular national and international sensitivity. It also underpins delivery of a range of S&T related strategic services.

More about Systems work

Systems engineering, or systems thinking, means many things to many people. In Dstl we describe Systems work as "bringing together the physical, the human and the conceptual elements necessary to achieve the best effect in the operational context". This work can be separated into two main areas, decision support and advice on innovative capability and systems concepts.

Decision support work assembles the evidence to support a key decision point in one of Dstl's customer processes. This is primarily an analysis and synthesis activity rather than a creative or innovative activity and includes deliverables such as detailed reports backed up by results from numerical and operational analysis, presentations to customers and other stakeholders in the decision, and designing and running decision support workshops. One example of

this type of systems work might be the tasking of Dstl to undertake a requirements definition study for a particular capability programme. In such a study, Dstl would analyse current assumptions and investigate the validity of these assumptions against criteria such as value for money.

Dstl's advice on innovative capability and systems concepts addresses the creation of new options, at defence capability or systems level and above, to tackle an existing or emerging capability gap. Dstl has unique access to a range of stakeholders, nationally and internationally, including government, military, industry and academia. As a result, it is well placed to offer integrated advice across the full spectrum of capabilities. The deliverables are typically a new, characterised concept for the customer to consider or some additional knowledge and understanding about existing options that advance the state of the possible. This work will usually require strong engagement with industry to cover elements such as concept development, systems engineering/integration, manufacturability, maintainability, usability, costs and whole life cycle issues.

One recent example is Dstl's support to the Future Aircraft Carrier which involved a comprehensive programme of work that included analysing the policy implications of the future capability, studying how MOD might smooth the peaks and troughs in the demands on the UK shipbuilding industry, assessing the level of technical risk in the programme and developing simulation software to explore operational concepts and tactics for the Future Joint Combat Aircraft.

Science and Technology

When people think of science and technology, they generally focus upon the exploitation of innovative technology, be that the creation of a new piece of technology or the exploitation of off-the-shelf technology in novel ways. Dstl is certainly involved in this aspect of science and technology and delivers not only the new technology but also an exploitation route that ensures the solution is available for the customer to employ directly or to use in a proof of concept or risk reduction exercise to underpin procurement. With an international track record in this area, Dstl conducts world-class fundamental research in a number of scientific disciplines. The new microbiological containment facility at Dstl's Porton Down site is an example of global best practice and allows our scientists to investigate novel medical countermeasures against biological warfare agents. Vaccines against plague and anthrax have recently been developed at Dstl and are now undergoing clinical trials through our industrial partner. Other vaccines under development include a component smallpox vaccine that is likely to have an equivalent protective effect with a significantly enhanced safety profile in man compared to the previous live vaccine offerings.

Dstl was recently commissioned to develop an alternative to the baton round, a less-lethal weapon used by the police to control serious public order disturbances. Supported by partners in academia and industry, Dstl undertook the research and development of the Attenuating Energy Projectile (AEP) round. As the design authority for the AEP projectile and cartridge, Dstl developed a novel projectile that has a crush zone in the impact face. This zone acts to reduce the peak force on stiff structures such as the head, therefore reducing the potential for injury, whilst maintaining the impact force on intended target areas such as the abdomen. Once developed Dstl undertook the full environmental testing of the prototype. Having been authorised for deployment by the Home Office, the AEP has been in use in Northern Ireland and Great Britain since June 2005 as an alternative option to firearms against individuals exhibiting or threatening serious violence.

The concentration on fundamental defence research and technology

development at Dstl has inevitably led to civilian exploitation opportunities. In order to enable Dstl to improve its exploitation performance without compromising its core business for MOD, a wholly owned subsidiary company, Ploughshare Innovations Ltd, was created and began trading in April 2005. Ploughshare acts as Dstl's technology management company with a remit to exploit intellectual property that Dstl selects to license to it. The company's long term aim is a virtuous cycle of intellectual property generation, exploitation and re-investment which delivers the best return, both economically and scientifically, for MOD, Dstl and the British taxpayer.

A number of exciting prospects for exploitation in the civilian market have already been identified from Dstl's current IP portfolio and, following agreement from MOD, are now under commercial development by Ploughshare through licence agreements and joint ventures. Acolyte Biomedica Ltd, one of 6 such joint ventures based on Dstl intellectual property, was formed in 2000. Its BacLite flex Rapid MRSA system has recently been evaluated by the London Independent Hospital which found the system to be fast, sensitive and cost effective for universal screening of patients to ensure that those colonised with MRSA can be isolated and treated before putting themselves and others at risk. The BacLite system is built on 15 years of original development work by Dstl scientists and is a first rate example of defence technology offering life-saving benefits to the public at large.

Support to Operations

Dstl plays a vital part in supporting operations and our contribution to both military and civil defence efforts is significant. Over one hundred Dstl staff have deployed to Iraq since 2003, of whom over eighty have qualified for the campaign medal by spending more than a month in theatre. They have participated in both systems and science and technology work, including operational analysis to support the General Officer Commanding MND SE, advising on equipment procurement and training, chemical and biological detection and inspection, and collecting data on weapons effects and battle damage. A small scientific team continues to work in theatre, reaching back to the

wider Dstl knowledge base so that they can respond to urgent operational requirements.

Dstl's Forensic Explosives Laboratory provides a unique capability to support the investigation into the criminal misuse of explosives. Scientists are available round the clock to provide front-line scientific capability, technical support and expert advice to the Police Service for any incident on the UK mainland. Frequently this involves attending the scene of an explosion to advise on the collection of forensic evidence, which is subsequently sent to Dstl for rigorous and detailed forensic analysis.

The types of forensic cases fall into a relatively small number of broad categories, including the examination of improvised explosive devices (IED's) that have been rendered safe; the assessment of finds and caches of explosive materials or bomb-making equipment; examination of post-explosion material, explosion scenes and debris and finally the collection and analysis of explosives traces. Sometimes, all of these various possibilities may be included in a single investigation. Dstl is also able to examine improvised devices that use toxic chemical or biological materials.

The forensic facilities at Dstl are externally accredited to the international quality standard ISO 17025 and were the first forensic laboratory in the United Kingdom to gain such accreditation. The Dstl scientists themselves undergo a rigorous in-house training and development programme culminating in external accreditation by the Royal Society of Chemistry and Council for the Registration of Forensic Practitioners (CRFP). This ensures that operations are conducted to the highest possible standards and the exacting requirements of the Criminal Justice System are fully met.

Working with others

Dstl must work closely with other bodies in government, industry and academia in order to ensure that MOD has access to the very best science and technology. Through our ongoing international research collaborations, Dstl is able to help MOD share the burden of research costs between the UK and our collaborative partners resulting in significant financial and technological benefits for all parties.

The Royal Commission on Environmental Pollution: Past, Present and Future

John Lawton, Susan Owens and Tom Eddy

The Royal Commission on Environmental Pollution met for the first time early in 1970, with Sir Eric (later Lord) Ashby in the chair. Created by Harold Wilson's Government, this new body was an important part of the institutional response to rising public and political concern about the environment. Its remit, defined by its Royal Charter, was (and remains):

“to advise on matters, both national and international, concerning the pollution of the environment; on the adequacy of research in this field; and the future possibilities of danger to the environment”.

The Commission has always interpreted the concept of “pollution” broadly, to include actions or substances from any source that damage or threaten human health and the UK or global environment.

Inevitably, thirty-six years after it was founded, the environmental issues with which the Royal Commission engages have changed in focus and character, but they remain as vital and as urgent as they were in the 1970s. At its inception, the primary concern of the Commission was with what we might broadly call “traditional pollutants” arising from point or diffuse sources. Its third report, for example, focused on the then very live issue of pollution in estuaries and coastal waters,¹ and had a significant impact on the *Control of Pollution Act 1974*. As the grosser forms of pollution have gradually been brought under control (with significant improvements in the UK environment as a result) the emphasis of the Commission's work has shifted to less visible and less tractable issues, such as global climate change and the synthetic chemicals that are now widely

distributed in everyday products. Throughout this time the Commission's work has influenced environmental policies and institutions not only in Britain but at a wider, European level. Many of its recommendations are embedded in legislation, and it has influenced (and been influenced by) profound shifts in thinking about environmental problems and appropriate policy responses.

Since its inception, the Royal Commission has produced 25 main reports and three special ones, covering diverse aspects of pollution and the environment. Certain reports have undoubtedly been landmarks, though some were ahead of their time and the measures recommended were not adopted until much later. Thirty years ago, the Commission surprised the establishment by arguing that there should be no major expansion of civil nuclear power unless it had been demonstrated “beyond reasonable doubt” that a method existed for dealing safely with high-level radioactive wastes.² In the same year, the Commission's far-sighted Fifth Report³ proposed a system of integrated pollution control, too radical for the government of the day but essentially what is in place today. At the height of the “lead in petrol” controversy in the mid-1980s, a skilful report persuaded the government to do a U-turn and support the move to lead-free.⁴ Some ten years later, *Transport and the Environment*⁵ was sharply critical of the prevailing “predict and provide” philosophy, and *Energy: the Changing Climate*,⁶ published in 2000, proposed the 60 per cent reduction in CO₂ emissions by 2050 that has subsequently become a goal of UK Government policy. Other reports have dealt with specific pollution problems, emergent technologies, the environmental

implications of key policy sectors, and the philosophical underpinnings for pollution control and the setting of environmental standards. Normally, the Commission selects its own topics for investigation, though ministers have directed its choice on three occasions, most recently in requesting a study of bystander exposure to pesticides.⁷



The Commission is an independent, interdisciplinary body, supported by a small secretariat. Commission members (currently 14, including the Chairman) work part time and are drawn from a variety of disciplinary backgrounds in the biological, physical and social sciences. Some members also have experience in sectors such as industry or agriculture. It is this diversity of intellectual and professional backgrounds that has led to the Commission being described as a “committee of experts” rather than an “expert committee”. It is also one of the Commission's great strengths, and has often enabled it to frame even familiar issues in new and challenging ways. All members serve in an individual capacity – the Commission is not a stakeholder body. Typically, Members serve for about six years, after appointment under “Nolan Rules”.



The Commission works by reviewing the literature, talking to those with relevant expertise and/or interests, including members of the public,⁸ organising seminars, visiting relevant locations, and taking extensive written and oral evidence. In reaching conclusions it takes into account the scientific, technological, economic, ethical and social aspects of the issues under investigation, and one of its powerful contributions over the past four decades has been to demonstrate how these different dimensions interact.

Royal Commission reports are submitted to the Queen, and then presented to Parliament by Her Command, published by the Stationery Office and made available through booksellers. An interesting departure for the most recent main reports has been to publish a summary as a separate, free booklet for wide distribution. As well as analysis, reports typically contain recommendations for action addressed to the UK Government and/or to the devolved administrations. The Government normally publishes a detailed response within a year, and Parliament is informed of the response. A debate may follow in either House.

The latest response – to the 25th⁹ report on the Marine Environment – was published in May 2006 and, in a welcome development, the Scottish Executive responded separately. An important element in delivering the Government response will be the proposed Marine Bill. To

date Government has failed to respond to only two reports, the eighteenth (*Transport and the Environment*, 1994), and most recently the Special Report on Aviation.¹⁰ Both deal with contentious issues of the kind that Governments of any hue find extremely difficult to resolve. They reflect a more general shift in the politics of the environment from the need to deal with the problems of production to the more complex dilemmas involved with lifestyles and consumption.

The Commission is currently completing work on its Twenty-sixth report, concerned with the urban environment, and is commencing its Twenty-seventh, on novel and new materials. Both are extremely timely. The Twenty-sixth report focuses on environmental aspects of urban living: human health, urban green-space, pollution, and resource consumption (the latter including water, which is moving rapidly up the political agenda). A now extensive literature on these issues suggests that we could, if we were so minded, greatly improve environments within, and reduce the negative impacts of, cities. But many problems persist or even worsen. A key challenge for the Commission is to understand why prescriptions that have so often been repeated are conspicuously difficult to implement in practice.

The study of novel and new materials will look at industrial use of novel elements from the periodic table, the novel use of more familiar

elements, and nano-particles. This is “heartland” Commission territory. Like the influential report on “genetically engineered organisms” in 1989,¹¹ it will explore rapidly developing applications for which major potential benefits are claimed, but which might pose risks to the environment and human health. As with GMOs in the 1980s, it is a field in which there is only a rudimentary regulatory framework.

The Royal Commission has an unusual remit. Its job is fundamentally different to that of a statutory agency or specialist advisory committee. It is also quite distinct from that of the Sustainable Development Commission, established in 2000, which is charged with the immediate task of auditing government and auditing their words and deeds on sustainable development. The two bodies keep in touch with each other's work and when appropriate may co-operate. For example, they have reinforced each other's distinctive contributions on aviation and on energy, in the former case holding a joint press conference to launch their individual reports.

The Royal Commission's role is to contribute to policy development at a strategic level for the longer term. To do this, it must review and anticipate trends, identify areas to which insufficient attention is being paid, conduct rigorous, in-depth analyses, and develop challenging new ideas and frameworks. It must go, as one commentator on Royal Commissions put it, “where ministers and their officials might hesitate to tread”.¹² These are fundamentally important tasks, and they will remain so as we confront the new challenges of environmental governance in the twenty-first century.

¹ Cmnd 5054, 1972

² *Nuclear Power and the Environment*, Cm 6618, 1976. The so-called ‘Flowers criterion’ is set out on page 81.

³ *Air Pollution Control: An Integrated Approach*, Cm 6371, 1976.

⁴ *Lead in the Environment*, Cm 8852, 1983.

⁵ Cm 2674

⁶ Cm 4749

⁷ *Crop Spraying and the Health of Residents and Bystanders*, RCEP, September 2005.

⁸ For example, the so called ‘bystanders’ in the recent study concerned with pesticide spraying.

⁹ Cm 6392

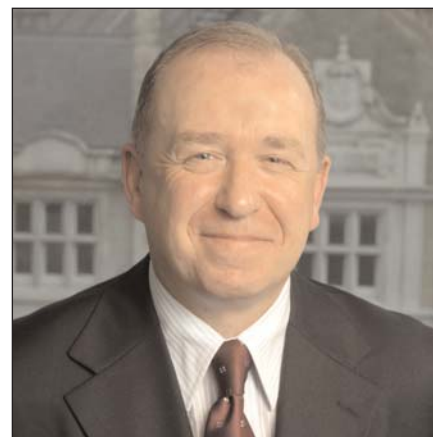
¹⁰ *The Environmental Effects of Civil Aircraft in Flight*, 2002

¹¹ Cm 720

¹² Cartwright, T.J. (1975) *Royal Commissions and Departmental Committees in Britain*, Hodder and Stoughton, London; page 217.

Parallel Medicines Distribution

*Richard Freudenberg,
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Pharmaceutical Distributors*



The article on counterfeit medicines by John Ferguson from the ABPI, in the Whit issue of *Science in Parliament*, contained a number of alarming inaccuracies about a so-called “link” between parallel medicines distribution and counterfeiting.

While counterfeiting is the manufacture and distribution of illicit products by unscrupulous businessmen, parallel distribution is:

- wholly legitimate;
- actively encouraged under the Treaty of Rome’s free movement of goods principles;
- fully licensed by national competent authorities; and
- delivers significant benefits to the UK economy.

What is parallel medicines distribution?

Parallel distributed medicines are medicines that are legally imported into the UK exclusively from other EC member states, repackaged for local markets and made available to patients through healthcare providers. Parallel importers are required to apply to the Medicines and Healthcare products Regulatory Authority (MHRA) for a licence for each individual drug they import.

Parallel imports provide patients with access to the latest drugs at lower cost and save the government and taxpayers money, which can be invested in other parts of the health service.

Parallel importation of patent protected medicines is for the time being restricted to the 15 EU countries. It does not take place from accession states such as Poland or the Czech Republic, or outside

Europe such as China, India or the United States.

Is it legal?

The UK parallel import industry has operated legally and safely in Europe for more than thirty years. It is actively encouraged through the EU’s founding Treaty of Rome which established a single, internal market through which goods, services, people and capital could freely pass. Parallel distribution in medicines is one of the best examples of genuine free trade across Europe that delivers real benefits to member communities.

How large is the market for parallel imported medicines?

Approximately 66 million packs are distributed annually in the UK (Jan-Dec 2005)¹. In 2002 the value of the UK market was estimated at approximately £1,300 million², though the market for various reasons has reduced in the interim.

One in seven prescriptions dispensed in the UK is parallel imported and 90 per cent of all pharmacists source some medicines in this way.

Economic benefits

Parallel distributed medicines generate savings for taxpayers as they cost the government less. Patients benefit as they have access to the latest drugs at lower cost. Pharmacists benefit as they can make additional savings by buying parallel trade medicines. In fact, many community pharmacists would struggle to stay afloat without the contribution made by parallel distributed medicines to their bottom line.

Direct savings from parallel distribution are estimated at up to £228 million, or 17 per cent of medicines expenditure³ of which approx 60 per cent passes to government and taxpayers and the balance to independent pharmacies.

Indirect benefits exist but are harder to quantify and may well be higher than the direct savings; these benefits include increasing competition which encourages pharmaceutical manufacturers and wholesalers to reduce the prices of domestically sourced products. Where no generic medicines exist, parallel distribution provides the only competition for branded medicines.

Both direct and indirect savings play a major role in containing the spiralling cost of medicines. In other parts of Europe, for example Germany, governments are promoting increased use of parallel imports to reduce pressure on the public health budget.

Quality and safety - our top priority

The MHRA will not allow a licence to be issued unless the imported and UK products are essentially therapeutically similar.

There are stringent rules governing the repackaging and marketing of parallel medicines just as there are for manufacturers. Every imported pack is subject to rigorous checks for every variable of strength, formulation and origin during processing. All imported packs have to be opened to accord with the requirements of the MHRA’s labelling guidelines, and to insert English-language patient information leaflets. Where packs

are opened, however, they are fully resealed before marketing. All facilities are regularly audited and subject to on-the-spot checks at any time.

No link between parallel trade and counterfeiting

There has never been a case of counterfeit medicines entering the UK supply chain through parallel trade. This fact is supported by the MHRA's head of intelligence, Nimo Ahmed, who says that there is no evidence of counterfeit medicines entering the UK supply chain through parallel imports.

This fact was reiterated by former Health Minister Jane Kennedy who dismissed any link with parallel imports, saying in July 2005 there was "no evidence to suggest that licensed parallel trade provides any more of an opportunity to introduce counterfeit medicines into the country over non-parallel traded products".

Parallel trade also has the support of the major high street chemists. David Loudon, Dispensing Category and Locations Manager at Boots, says that most community pharmacies in the UK have been providing prescription only medicines imported from the EU for many years and Boots believes they play an important role in maintaining continuity of supply.

"We believe that parallel imports have an excellent safety record and that there is no evidence to link them with incidents involving counterfeit medicines entering the UK supply chain."

Maintaining the integrity of the supply chain

Although there has never been a case of counterfeit drugs linked to parallel trade in the UK, BAEPD members are committed to maintaining the integrity of the supply chain to ensure patients are protected.

Parallel trade is highly regulated with a series of safeguards to protect patients.

Parallel importers only import from fully licensed and MHRA-approved wholesalers, whose national wholesaling credentials have been audited. Long-term supply relationships developed over many years are in place, which provide trustworthy provenance of the goods. In the vast majority of cases medicines are imported direct from the exporting wholesaler (who has in turn received his supplies direct from the laboratories), repackaged by BAEPD member companies, under the supervision of MHRA-registered Qualified Persons, and distributed direct to the wholesaler or retail pharmacist. Best practice guidelines are conditional on BAEPD membership.

In fact, we believe parallel distribution acts as an additional safety measure. Whilst counterfeit product thankfully remains remarkably rare, we have frequently identified manufacturers' errors during the repackaging process.

If product recalls are required, parallel distributors perform these as efficiently and comprehensively as any other pharmaceutical distributor. We work closely with the MHRA to recall drug batches where necessary. Batches are traceable back to their European source.

Playing our part to help beat counterfeiters

We are committed to doing everything we can to assist in the fight against counterfeiting, providing our traditional and completely legal supply chains are not threatened. The BAEPD is part of an NHS-led taskforce examining bar coding and other ways to improve medication safety.

However, we see the major threat in counterfeiting coming from online sales, not parallel trade. Internet sales are effectively unregulated and have no quality assurance. We believe efforts should be concentrated in this area, a view supported by Government and the MHRA. Everyone involved in the industry needs to maintain vigilance at all times if we are to ensure patients are protected.

Parallel trade under threat

The benefits brought by parallel trade are currently under threat. What John Ferguson's article does not address are the lengths manufacturers are prepared to go to prevent parallel trade. Quotas are one way the industry has sought to restrict supplies and put pressure on the parallel medicines business. While imposing quotas is officially illegal under European law, drug companies know it will take many years for the EC to act. There have also been attempts to introduce dual pricing, a practice which we believe is also illegal and currently being challenged in the courts.

Manufacturers also claim that parallel distribution reduces investment in research and innovation. However, in May 2001 the European Commission found that contrary to claims by the then GlaxoWellcome, there was "no convincing evidence" that parallel trade affected the firm's R&D budget. The latest EFPIA (European Federation of Pharmaceutical Industries) annual report shows that pharma companies' spend on R&D has increased by 171% (1990-2004), with overall sales up 167% in the same period. Another recent report: *Health at a Glance: OECD Indicators 2005* reveals that pharmaceutical spending is a key driver of OECD health budgets. In most countries, growth in pharmaceutical spending has outstripped growth in overall health spending – in some cases by a factor of two.

Conclusion

While manufacturers continue to look for ways to limit our business and tarnish the reputation of BAEPD members, we will continue to operate in a proper, fair and legitimate manner – defending our rights and our reputation for the benefit of patients and taxpayers throughout Europe.

¹ IMS data: 1/1/05-31/12/05

² Benefits to Payers and Patients from Parallel Trade, York Health Economics Consortium, May 2003

³ Benefits to Payers and Patients from Parallel Trade, York Health Economics Consortium, May 2003

Richard Freudenberg is Secretary-General of the British Association of European Pharmaceutical Distributors (BAEPD). The BAEPD represents 14 of the largest licensed parallel distributors in the UK and is responsible for the promotion, protection and development of parallel trade and fostering the highest professional standard of practice and conduct amongst members.

Breeding and Welfare in Companion Animals

Roger Gale MP and Lord Soulsby of Swaffham Prior

We jointly acted as hosts to a Reception for the Companion Animal Welfare Council (CAWC) on 16th May 2006 at the House of Commons to mark the publication and launch of the CAWC Report on Welfare Aspects of Modifications, through Selective Breeding or Biotechnological Methods, to the Form, Function, or Behaviour of Companion Animals.

The cover illustration to the report shows a magnetic resonance image provided by Clare Rusbridge MRCVS of the head and neck region of a 16-month, female cavalier King Charles spaniel (which had a 3 month history of yelping and tendency to scratch at the right shoulder). The back part of the brain is pushed into the canal into which, normally, only the spinal cord passes. Resulting abnormal cerebrospinal fluid pressure in the spinal cord has caused syringomyelia – the formation of fluid filled cavities in the spinal cord. This disease which is due to a hereditary mismatch of brain and skull design, resulting in inadequate skull capacity, occurs commonly in Cavalier King Charles spaniels and is associated with signs of chronic, and in some cases severe, neck pain in a proportion of affected dogs.

This condition illustrates how selection for particular traits can have unforeseen serious side effects on welfare. Although the particular aspects of appearance or behaviour the then breeders were wittingly or unwittingly selecting for, that led to this disease, is unknown. The Cavalier King Charles Spaniel breed was developed in the 1920s in response to a reward offered for

recreating a toy spaniel with a longer nose as depicted in portrait paintings of King Charles II. The modern breed is descended from about six animals.

There has been a rapid growth in the number of species of vertebrates and invertebrates kept as companion animals and, in the UK, this exceeds 1000 vertebrate species alone. Many hundreds of these species are bred for this purpose. A considerable number of species have been selected for specific traits, or suites of traits, for countless generations (eg dog, cat, rabbit, pigeon, goldfish) and include breeds that differ markedly in appearance from their wild ancestors. There has been a great drive for novelty amongst companion animal breeders.

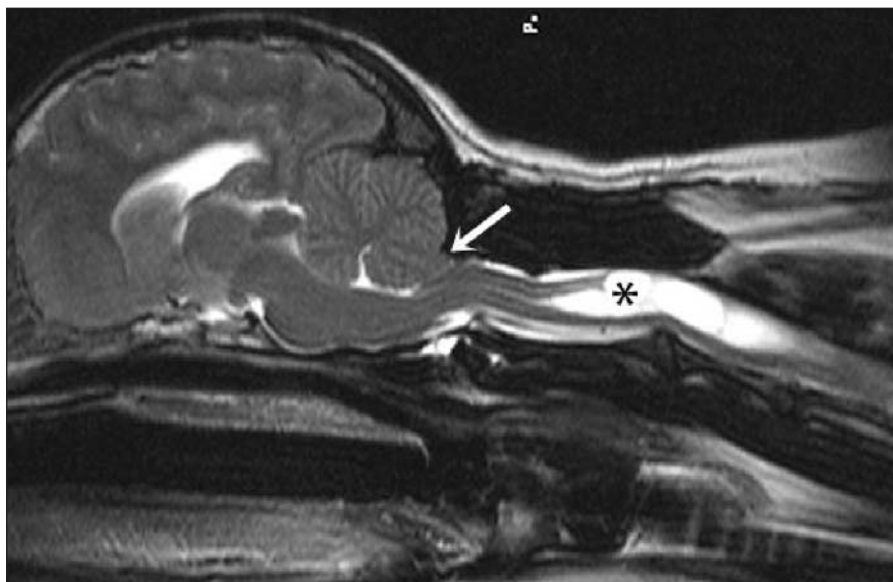
Historically at least, most companion animal breeding has been undertaken in pursuit of specific aspects of performance, appearance and temperament (eg speed, size, colour, shape and behaviour) with little or no specific regard to the possible welfare consequences.

The “creation” of new strains, characterised by these and various other features, is, with few exceptions driven, not by a process of actively generating new forms – it is nature that does this – but by actively selecting and breeding from “new” mutant forms that arise spontaneously or from those individuals that most nearly approach the ideal being selected for. The process works largely by not breeding from those animals that do not meet the ideal being selected for, rather than by accelerating the breeding of those

that do.

Protected from the rigours of natural selection, under human stewardship, individuals can survive and breed that would not do so in the wild. The very strong constraints to so-called desirable traits and other aspects of biology imposed by survival of the fittest in the wild are relaxed through captivity/domestication, and this has opened the way for the extraordinary diversification of forms that has occurred.

The methods that have been used in the development of companion animal breeds – breeding from small numbers of animals in the selection of particular traits and the use of sibling or parent matings in the “fixing” of these traits in “true-breeding” lines – tend all too often to lead to significant inbreeding and the accumulation of potentially harmful alleles. As a result many problems with clear welfare consequences are known to have arisen in association with selection for specific traits or suites of traits. These include, to give some examples: hip displasia in dogs; osteosarcoma (bone tumors) in giant breeds of dogs; predisposition to intervertebral disc disease in dachshunds; brachycephalic airway obstruction syndrome in bulldogs; various problems in Manx cats such as mega colon and constipation; predisposition to squamous cell carcinoma in white coat colour cats; glaucoma in Siamese cats; baldness in Sphynx cats with increased potential for sunburn and climatic discomfort in cold weather; lethal white overo syndrome in horses from breeding two overo paints (coloured breeds in horses) leading



Chiari Malformation and syringomyelia in a cavalier King Charles spaniel

We are grateful to Clare Rusbridge BVMS DipECVN MRCVS for this Midsagittal T2 weighted MRI of the brain and upper cervical spinal cord from case 52, a female CKCS that had signs of pain from 1.7 years old. Clinical signs included yelping whilst scratching at the right shoulder area. This was more likely when she was excited.*

Copyright of Clare Rusbridge MRCVS

to atresia coli and gut blockage; tumbling in pigeons with tumbling in flight; predisposition to vitamin A deficiency in white canaries and complications in health associated with long fur rabbits. These are a few examples across the range of companion animal species that have a genetic basis for conditions which may seriously compromise welfare.

Welfare problems associated with genetic changes to the phenotypes of animals can be particularly serious in that:

- (i) they can affect a large number of animals
- (ii) they have the potential to do so for many generations into the future
- (iii) they can have a serious adverse impact on animals' feelings (eg through pain or increased fearfulness) and,
- (iv) these effects can be of long duration – potentially affecting the animal throughout its life (and they may also affect lifespan)

New techniques in breeding are increasingly being explored. These

include genetic engineering and cloning.

Genetic engineering is the use of artificial means to manipulate gene combinations in organisms. A transgenic animal is one whose DNA includes genetic material (one or more genes) from another species. The use of genetic engineering is currently largely confined to farm and laboratory animal industries. However, some have predicted that it may not be long before this technology is more widely applied in companion animals.

It is to be hoped that, in the future, genetic engineering techniques could be used to benefit the welfare of companion animals through the replacement of harmful alleles with healthy ones. This methodology may offer an approach to tackling some of the genetic problems that have been created through selection for particular breed traits. The high prevalence of specific diseases within certain breeds suggests that a limited number of loci underlie some of these diseases and it has been suggested that determination

of the genetic basis of these problems may be more tractable in dogs than in humans. Modern genetic methods have been used for genetic manipulations in farm animals aimed at health improvements such as increased resistance to infections and infestations. Such approaches may come to be applied in companion animals also in the future. However, the technology is not without potential welfare costs and these would need to be carefully taken into account in considering any proposal to use the technology for such purposes.

Despite initial doubts that cloning was ever likely to be applied in the companion animal field, it now appears that it could come to be applied extensively and gene banking services are now being set up whereby clients pay for the storage of genetic samples from their companion animals from which it may be possible to produce clones in the future.

In contrast to society's apparent concern for the welfare of animals and for strict animal welfare regulation, it seems that an almost unquestioning acceptance continues to prevail regarding the selection and breeding of companion animals for arbitrary traits, despite the great potential for serious welfare consequences.

The CAWC therefore proposes the following brief code based on the Council of Europe Convention (Council of Europe, 1987):

"The selection and breeding of companion animals can result in, or perpetuate, characteristics or inherited conditions that seriously affect the quality of animals' lives. No one should breed companion animals without careful regard to characteristics (anatomical, physiological and behavioural) that may put at risk the health and welfare of the offspring or the female parent."

The complete report may be obtained from the CAWC Secretariat at: The Dene, Old North Road, Bourn, Cambridge, CB3 7TZ; or downloaded from the Council's website at www.cawc.org.uk or www.companionanimalwelfarecouncil.co.uk.

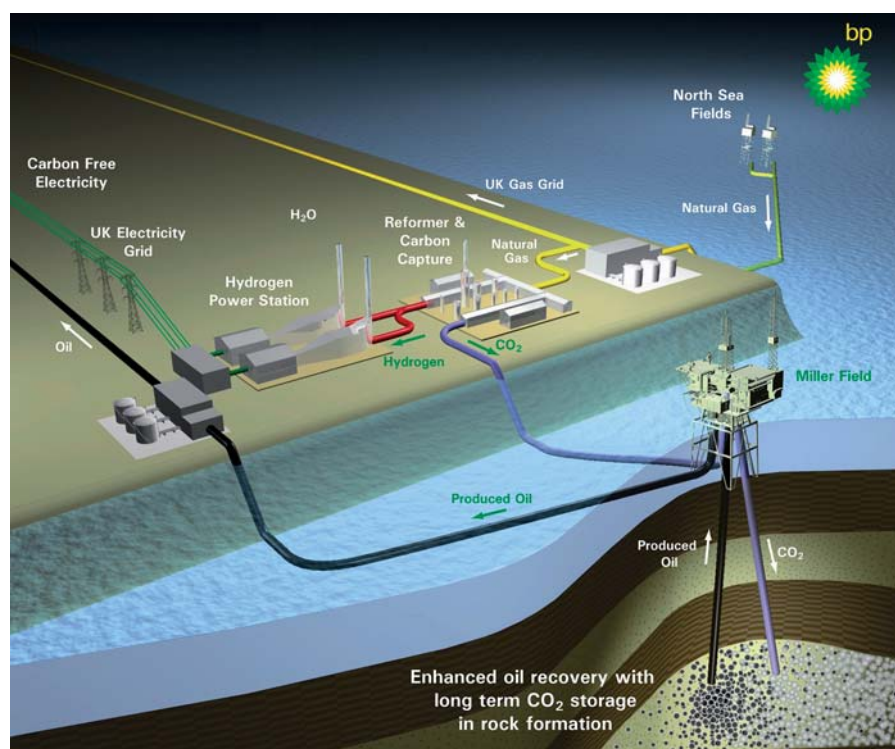
Low Carbon Power with Carbon Capture and Sequestration - a world first for the UK

Lewis Gillies, Director, Hydrogen Power,
BP Alternative Energy - BP's carbon free and low carbon power business.

At the end of June last year BP announced plans for the world's first industrial scale hydrogen power project with carbon capture and sequestration. The power plant would be built at Peterhead alongside an existing Scottish and Southern Energy (SSE) power station and take natural gas from North Sea fields which would be put through a reformer to convert it into hydrogen, a clean burning gas, and carbon dioxide (CO₂).

SSE is BP's partner in this project which would use the hydrogen to produce 475MW of low-carbon electricity in a new power station – enough to power some three quarters of a million homes. The process will capture 1.8 million tonnes of CO₂ per year that will be transported some 240km via an existing pipeline to the Miller field where it will be injected 4km underground into the oil and gas reservoir. It will enable production of some 57 million barrels of oil that would not otherwise have been recoverable – more than the size of an average new field discovery in today's North Sea – extending the life of the field by about 15-20 years. The CO₂ will remain permanently stored in the reservoir rock which has a natural impervious cap and has naturally held gas, with a large proportion of naturally occurring carbon dioxide for many millions of years. If the project is not able to proceed now, the Miller field will have to be decommissioned, as originally scheduled, next year and this opportunity to kick-start carbon capture and sequestration (CCS) will be lost.

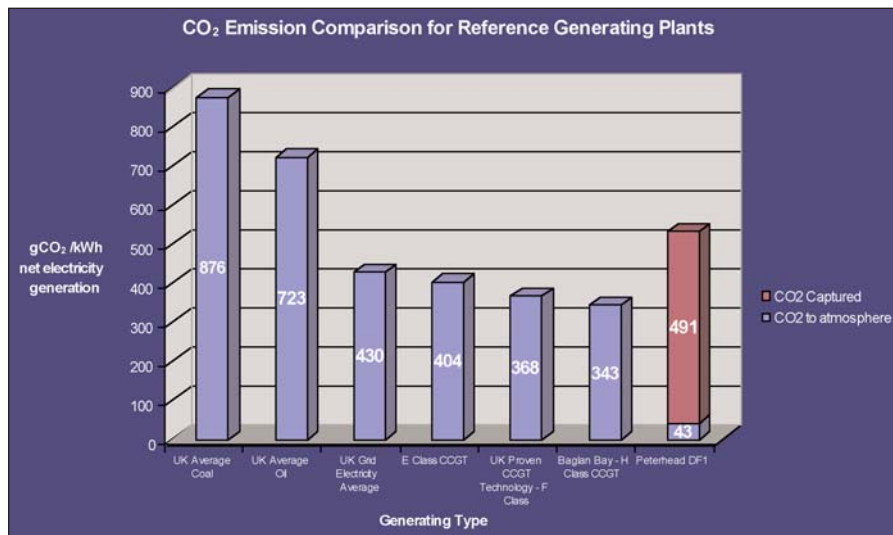
The global power sector accounts for some 40% of all man-made CO₂ emissions and as such is a natural industry to target to make substantial reductions in emissions



of this greenhouse gas. The enclosed graph demonstrates exactly how radical a step the Peterhead plant will represent in enabling a move to a low-carbon future. Recent generations of gas fired turbines – the cleanest fossil fuel – have been making incremental reductions in the amount of CO₂ emitted per unit of electricity generated such that a modern 'F' class turbine emits some 368g CO₂/kwh net electricity generated. However, Peterhead is expected to emit just 43g CO₂/kwh net electricity generated – 90% less than the current average for UK electricity, even after taking renewables and nuclear into account. Not only is this a step change towards making fossil fuel power generation comparable with renewables in terms of CO₂ emissions it also has a couple of other advantages. It will be base load power which does not have the intermittency of most forms of

renewable power and, in a single project, will deliver as much power as is currently generated by all the UK's wind farms.

Significantly, the technologies that are being brought together at Peterhead can be applied to all forms of fossil fuel, including coal. This has obvious implications for the future of coal in the UK which currently emits 876g CO₂/kwh net electricity generated but could also see a similar carbon capture rate. The even greater prize in tackling global climate change is for rapidly developing countries such as India and China which have enormous reserves of coal and are currently opening a new coal fired power station every week. This new approach to power generation enables countries like this to continue their rapid economic development while also taking an active part in the global campaign to tackle climate change.



BP, as an integrated oil and gas company, is one of a few companies that has an understanding and experience of the technology this project calls for. The technologies used in the various steps of the process have been used at scale in different places around the world in different industries but this will be the first time they will be brought together. For instance, the reformer is of a similar size to one BP has in Trinidad; experience of the capture of the CO₂ comes from the In Salah project in Algeria; the company has numerous power generating facilities, including at its refineries; and the turbine vendors have proved and warranted the firing of hydrogen in the turbines. Finally, from the USA, BP brings extensive experience of transporting large volumes of CO₂ and our North Sea assets provide a comprehensive understanding of the Miller field, wells, geology, and the behaviour of both liquids and gases in rock.

BP and SSE currently estimate the cost of the Peterhead project to be approximately £750 million. The reforming of the natural gas, capture of the CO₂, its transportation and storage inevitably mean this is more costly than a conventional gas fired power station. However, the company is sufficiently convinced of the need to move to low-carbon power generation that it is prepared to carry the risk of the novel technology application and to make as substantial investment as this project represents.

As they stand the project economics are competitive with other forms of low carbon, or carbon free, power. These challenging economics include the offshore part of the project where the costs of retro-fitting the

platform for its new life are not fully compensated for by the expected revenue from the additional oil that will be recovered. As has been required by other new sources of low carbon power, a power generation industry with CCS needs a policy framework that allows the cost to be spread across the electricity market. To provide the Peterhead project with a rate of return appropriate for the level of capital and technical risk, it needs a level of support equivalent to that provided to renewable forms of energy in the UK through the Renewable Obligation.

The Peterhead project will require that level of support throughout its life because of the technology choices that are made at the outset. Like all new technologies it is expected the costs for subsequent projects will come down with time. We are already seeing that the mere decision to move ahead with a commercial scale project is pushing technology down this cost curve. For instance, the detailed engineering studies that are now under way have already produced greater turbine fuel efficiency and a higher rate of CO₂ capture than was envisaged just six months ago.

BP has analysed a number of different policy support mechanisms, or combination of mechanisms, that the UK Government might consider making available to this first-of-a-kind project to enable it to go ahead. These have included both policy frameworks already in use to incentivise low carbon, or renewable power, as well as analogues of these and new mechanisms. It is also hoped the EU Emissions Trading Scheme will be adapted to recognise carbon capture and sequestration.

BP is largely indifferent as to how this support is provided so long as the total enables the project to proceed with a level of return commensurate with the risk.

Conscious of the lack of knowledge that the novel nature of the project creates and the Government's need to not over-reward the project, BP has provided the Government with a copy of the economic model of the project. It can use this to see what effect any policy framework would have on the project economics. Because of the importance of making substantial contributions to tackling the climate change issue, and of seeing this first-of-a-kind project happen, BP has offered to cap the rate of return on the project. Also, in the event of the project being more successful than is currently anticipated, BP is amenable to some form of claw back mechanism so that the cost to the Government or consumer is reduced.

In announcing plans for this project BP is continuing its commitment to tackling the climate change issue and its leadership role in industry on this issue. It was followed, in November, by the announcement of the formation of BP Alternative Energy, a new business dedicated to low-carbon and carbon-free energy. It brings together BP's gas-fired power generation, wind and solar businesses as well as hydrogen power. It has aggressive growth plans and an \$8bn capital investment budget for the next ten years.

BP's commitment has already resulted in the announcement of plans for a second hydrogen power plant with CCS which will be built next to the company's refinery at Carson in southern California. As an indicator of the potential for using coal, this will take petroleum coke, a synthetic form of coal and a by-product of the refining process, as its feedstock. Of many other projects that the company is looking at around the world, several involve coal itself.

The first power plant in the UK with CCS can be built to provide the UK with substantial greenhouse gas emissions reductions in time to help meet the Government's 2010 targets as well as provide the country with a world beating project. BP and SSE will be able to make the final investment decision to build it early next year, provided the policy support is forthcoming by the end of this year.

Britain's Younger Researchers – Taking Real Science to Parliament

Eric Wharton, SET for BRITAIN

After several years of organising successful Science Weeks in the Thames Valley, I said to Robert Jackson, my MP at that time, “How about taking a few younger researchers to the House of Commons to enable them to present their work there?”. Robert replied, “an excellent idea, let’s do it”. Realistically I anticipated that we would be doing well to get fifty applicants, however we had 350 in that first year! I had previously discovered Brian Iddon MP in one of our early Science Weeks on the chemistry “lecture-demonstration” circuit, prior to his election in 1997 and I therefore brought him in as Co-Sponsor.

Twenty-two such Receptions have now been held, according to those responsible for providing the exhibition boards, aided by enthusiastic Sponsoring Members and Champions at Westminster including Robert Jackson MP, Dr Brian Iddon MP, Claire Curtis-Thomas MP, Dr Doug Naysmith MP, Dr Evan Harris MP, Richard Page MP, Ed Vaizey MP and Dr Ian Gibson MP.

It is very encouraging to realise that Britain’s younger researchers continue to appreciate this opportunity to discuss and present their research at Westminster to about fifty Members and a few Peers, who visit the posters and their presenters and who are impressed and thrilled by Britain’s future scientific leaders.

The basic objectives of these Receptions are as follows:

- Presenting “ground-breaking” research and R&D at Westminster
- Encouraging better personal interaction between researchers

- Fostering greater interactive dialogue between younger researchers and Members in Westminster and in their Constituencies
- Competing for a prestigious Medal and Prize for the best poster representing the best research

Many researchers gain an awareness of the challenges and excitement in other areas of research, possibly resulting in collaborative projects. They receive a brief introduction to Parliament and discover also how Parliament deals with science, engineering, medicine and technology.

The more adventurous may strike up relationships with Members and invite them to their laboratory or to their local pub. Members are often enthused by the commitment and dedication of the researchers, many of whom are working on topical or societal problems leading to a better world. A national Competition for a Medal and a Prize is an important aspect of each Reception – some of the Prizes are at the £5,000 level, which was introduced by Richard Page MP for the younger engineers’

Reception. Very substantial Prizes are awarded in literature and art, so why not in science? The awards are for the merit and quality of research and all presenters are also encouraged to discuss the benefits of their work in relation to Science and Society and to demonstrate any ethical, societal and commercial implications.

Three Receptions have been held in the previous six months:

The fifth annual **Reception for younger engineers** was held on 6 December 2005 (Dr Douglas Naysmith MP and supported by BP, ExxonMobil, BNFL, Rolls-Royce, Vodafone, RWE npower, Thames Water, Royal Academy of Engineering – 110 posters). **Daniel Walker**, a research student from Oxford University, was the winner of the 2005 Gold Medal and the £5,000 Prize for his research which is relevant to the oil and gas industry, relating to the interaction of extreme ocean waves with offshore structures.

The **Annual SET Week Reception** was held on 13 March 2006 (Dr Brian Iddon MP and supported by GlaxoSmithKline – 260 posters) for



8 May 2006 Bioscience Reception Prize-Winners with Dr Evan Harris M.P.



Dr Brian Iddon M.P. with 13 March 2006 Lunchtime Prizewinners

Britain's younger researchers from any branch of SET/STEM. **Dr Christopher Mee** of the MRC at Oxford University and **Richard Page** of Cambridge University won the 2006 Westminster Medal and £1,000 Prize for their work on using a simple invertebrate research model (*Drosophila melanogaster*) to mimic the effect of A β , peptide accumulation found in the brains of Alzheimer's Disease patients.

Dr Carolyn Moores of Birkbeck College won the 2006 De Montfort Medal and £1,000 Prize for research using electron microscopy to observe brain development and to describe the consequences of failure to develop correctly.

A Reception for UK Bioscience took place on 8 May 2006 (Dr Evan Harris MP and supported by ABPI, BBSRC and MRC and others – 170 posters). There is rapid growth in bioscience, biomedicine and medicine in the UK. **Leanne Bellamy** from Imperial College won the 2006 Mendel Medal and £5,000 Prize for her thorough review of existing literature (2.6 million women) which found that women who had pre-eclampsia were twice as likely to develop heart attacks, strokes, blood clots and high blood pressure in later life, about 10 years after their affected pregnancy. The Runner-Up was **Dr Ian Prior** of Liverpool University, who uses

novel techniques with the electron microscope to investigate previously invisible cell surface features. These provide information that help in understanding how diet and viruses such as HIV affect cell surfaces.

SET for BRITAIN's overall aim is to encourage, support and promote Britain's younger scientists, engineers and technologists. This is the "engine-room" of progress in research and R&D which is the cornerstone of maintaining and developing the UK economy and the health and quality of life of the UK people – and is a vital resource, asset and investment for the UK. These Receptions are only one, but

a very important one, of the SET or STEM activities held in the Houses of Parliament every year.

Thanks are due to the Sponsoring MPs, and the organisations referred to above and others such as NERC, PPARC, EPSRC, IOP and many Members, the Poster Judges, learned societies and associations and staff of the House of Commons for their help and encouragement with these Receptions.

Forthcoming Receptions:

Younger Physicists (Ed Vaizey MP, Lunchtime on 28 November 2006, the 2006 Cavendish Medal and Prize)

Younger Engineers (Dr Doug Naysmith MP, Lunchtime on 12 December 2006, the 2006 Gold Medal for Excellence in Engineering and £5,000 Prize)

Younger SET/STEM Researchers (Dr Brian Iddon MP, Lunchtime and Evening on 19 March 2007, the 2007 Westminster and De Montfort Medals and Prizes)

UK Bioscience (Dr Evan Harris MP, Lunchtime on 14 May 2007, the 2007 Mendel Medal and £5,000 Prize)

There will also be important Runner-Up Prizes for each Reception.



Dr Brian Iddon M.P. with Dr Carolyn Moores (De Montfort Medallist) and Cuauhtemoc Rodriguez (Millennium Medallist) at 13 March Evening Reception

Contact: Dr Eric Wharton, SET for BRITAIN at ew@s-f-e.org
By "science", this generally means science, engineering, technology, medicine
Photographs courtesy of Frank Dumbleton

OUR ENERGY FUTURES FOR SECURE AND SUSTAINABLE POWER: FROM CLEAN COAL TECHNOLOGY WITH CARBON CAPTURE AND STORAGE, MICROGENERATION, TIDAL, WIND AND NUCLEAR

MEETING OF THE THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE ON MONDAY 24TH APRIL 2006

A sharp decline in the generation of North Sea Gas has resulted in the UK becoming a net importer of energy for the first time ever. This coincided with market failure that gave rise to unscheduled and sudden cost increases for domestic consumers of both gas and electricity and the possible threat of supply interruptions for imported gas. These events have prompted an urgent review of UK energy strategy for the longer term.

The ownership and control of effective, economic, secure and sustainable energy sources that are compatible with Climate Change are increasing in importance if we are to manage our economy in the future. Decision time is upon us therefore, unless we are prepared to accept whatever may be left at the end of the pipeline.

Bringing Clean Coal Technology into the UK Generation Portfolio

Dr J M Farley

Director of Technology Policy Liaison, Mitsui Babcock Energy Limited



Introduction

Mitsui Babcock has been a leader in development of power generation technologies since the company was formed in the UK in 1891 and it continues to lead particularly in advanced clean coal firing technology. The company believes that the UK should have a diverse, balanced fuel supply portfolio which will deliver secure supply at affordable prices with minimum CO₂ emissions. Carbon abatement from fossil fuel power generation should be the highest priority amongst all supply-side technologies with the objective stated in the DTI Strategy for Carbon Abatement Technologies for Fossil Fuels "To ensure the UK takes a leading role in the development and commercialisation of carbon abatement technologies that can

make a significant and affordable reduction in CO₂ emissions from fossil fuel use".

Reduction of carbon emissions is required, but must be considered in conjunction with, crucially, maintaining security of supplies and reasonable, stable energy prices. This requires consideration of the alternative "fuels" (and their carbon footprint) and the timescales necessary for the building of power plants on a meaningful scale against the demand requirements in the generation system and the relevance of the measures on a global scale.

Carbon dioxide Capture and Storage (CCS) from fossil fuelled plants, coal and gas, has very great potential for the UK and even more importantly for the major coal using countries of the world like China, India, USA and Russia. A precursor

to CCS is the introduction of carbon-abated clean coal technology. Such technology is available now and could be operational in 3 years as retrofit plants or in 4 years as new plants. Carbon-abated clean coal technology could thus be applied in time to contribute significantly to filling the UK energy gap of 2015.

Carbon-abated Clean Coal Technologies

A major opportunity exists by adoption of carbon-abated clean coal technology which can reduce emissions whilst generating electricity at a competitive price. Adoption first of Track 1 and then Track 2 carbon-abated clean coal technologies as defined in the government's CAT strategy would reduce emissions progressively by

20% to 40% (Track 1, available now) and later 90% (carbon dioxide capture and storage). Track 1 CAT technologies (higher efficiency Advanced Supercritical Boiler/Turbine and Biomass cofiring as new build or retrofit or existing power plants) are the lowest cost reduced carbon supply-side technologies. Building capture-ready Advanced Supercritical coal-fired plant would set the right example to major users of coal worldwide, and kick-start early adoption of cleaner technology in countries such as China and India, which have a track record in using UK power plant technology and a huge and growing dependence on coal as an energy source.

Since coal and gas are both seen as major contributors long term, the Government needs to implement an array of policy measures to achieve reduction of carbon emissions by ensuring *investment* in the cleanest technologies for coal and for gas. These measures have to avoid driving more fuel switching from coal to gas since this would adversely impact security of supplies and expose customers (domestic and industry) even more to higher prices. Our views on various measures are given below.

Government Policies on Clean Coal

At present, carbon trading is not driving more than minor incremental changes and has an inherent tendency to drive switching of electricity generation from existing (less than optimum) coal plant to existing less than optimum gas-fired CCGTs. It is not reliable enough (in terms of certainty of CO₂ price), nor long-term enough to allow bankable investment decisions. Presently it is just working to move cash from electricity consumers through the generators on to the holders of excess CO₂ Allocations, mostly outside the UK.

However, we believe the UK National Allocation Plan could be implemented in a way that would

incentivise investment in the cleanest coal and cleanest gas technologies. This would require an adequate New Entrant reserve, separate BAT benchmarks (g/kWh) for CO₂ for coal and gas and a long-term commitment to the duration of the Allocations awarded.

It is very important that the rules for New Entrants and Retrofitted plants are set correctly for 2008-12 since these rules will influence investments for many years. If the wrong rules are set then these rules will run counter to the Government's security-of-supply objectives and any investment incentives introduced by the Government would then have to be more generous than otherwise necessary. The Secretary of State should use his powers to require use of Best Available Technology² for all new fossil fuelled power plant or refurbished/retrofitted plant permitted from 2006 onwards and should require all plant (except GQCHP) to be designed to be "capture-ready"³.

There is currently no Low Carbon Incentive for fossil fuels or nuclear comparable to the Renewables Obligation, and the incentive which exists (Carbon Trading), as stated above, incentivises fuel switching coal to gas rather than major investment. An incentive for low carbon sources would not need to be so generous as the Renewables Obligation, but would need to be carefully designed to avoid driving fuel switching to gas because of the low initial capital costs of gas-fired power plant, with consequences for security of supplies and high price risks.

Cofiring of biomass in place of coal in large power plants is the most efficient and cost-effective way of using this renewable fuel – 1.5 times more MWh and CO₂ reduction in an advanced supercritical power plant than in a dedicated small-scale biomass plant. Since it is now clear that large coal-fired plants will remain in the generation mix, more not less

cofiring of biomass should be encouraged and, with a view to the longer-term growth of biomass energy crops in the UK, this should be strongly encouraged by appropriate changes to the Renewables Obligation.

Advantages of Coal

Coal has a high energy density and the advantage that it can be stockpiled cheaply and safely, is sourced from politically and economically stable countries around the world, with 200 years proven reserves. Supplies of coal are much less likely to be disrupted than supplies of gas, which are especially vulnerable to terrorist or insurgent action directed at pipelines along the supply routes. 40% of the UK's coal needs are produced from indigenous sources, at prices which now match those of imported coal. Coal prices are much more stable than gas or oil and are predicted to remain so. Over the longer term, the relative abundance of global coal reserves, including significant UK reserves, compared with the relative paucity of gas reserves, including declining UK reserves, means that the price differential must move inexorably in favour of coal.

If the generation gap is filled by coal then the current healthy diversity of fuel mix for power generation would be maintained. Coal plants can be built in 3 years (retrofit) or 4 years (new build) from completion of permitting. Only plants ordered by 2011 will be operational by the end of 2015, and recognising world-wide industry capacity, a steady build programme with, say, 4 GW of project starts per year from 2007 to 2011 is needed.

¹ Details of these technologies are given in Mitsui Babcock document "Clean Coal Technology and the Energy Review", www.mitsuibabcock.com, and in DTI Best Practice Brochure, BPB010 – Jan 2006 – "Advanced Power Plant using high efficiency Boiler Turbine"

² For coal BAT would be capture-ready with an ELV for CO₂ of 750g/kWh and for gas BAT would be good quality CHP or capture-ready CCGT with an ELV of 350 g/kWh

³ ie suitable for the later addition of Carbon-dioxide Capture

Local Sustainable Energy

Adapted from a presentation by

Allan Jones MBE

Chief Development Officer, London Climate Change Agency



Electricity is currently supplied nationwide by means of a grid system that commenced operations in 1926. This national grid is based on electricity sourced mainly from a few very large fossil fuel generators located near coal mines and major rivers, such as the Trent, which supply cooling water; offshore natural gas fields such as Morecambe Bay; and nuclear plant in remote coastal locations such as Sizewell, which are very wasteful of the total heat and electricity generated. The national grid system thereby loses as much as two thirds of the total energy produced, mainly as wasted heat generated at the power station, but also through the distribution system. The combustion of fossil fuels to generate CO₂ in industrialised economies is also one of the principal contributors to climate change. The fact that most of the total energy generated is also wasted is no longer acceptable as a component of a rational plan designed to economise on fossil fuel combustion and to combat climate change.

In 2004 I was invited to take up the challenge of replicating in London the work previously achieved by Woking Borough Council. The Council had previously received the Queens Award for Enterprise: *Sustainable Development 2001 in respect of Energy Services activities undertaken in the development of Local Sustainable Community Energy System* with the help of Danish investors who were familiar with the technology employed. The system is based on locally situated combined heat and power (CHP) co-generation units burning natural gas, leading to tri-generation with the addition of cooling and subsequently hydrogen production as fuel for transport. Summaries of the Energy, Environmental and Financial Savings and the Climate Change Strategy adopted by Woking from 1 April 1991 to 31 March 2004 are presented in Figs 1 and 2. A recent Greenpeace article *Decentralised UK Energy* also suggests that it would be cheaper and more sustainable than the nuclear option to convert every building in major cities into mini power stations, each providing as much energy as possible for their own use, and thereby gradually extending the Woking model more widely across the commercial sector and domestic housing stock.

The Mayor of London, Ken Livingstone, who is responsible for the Greater London Authority, Transport for London, Metropolitan Police, London

Summary of Energy, Environmental and Financial Savings 1 April 1991 to 31 March 2004

Energy Consumption Savings	244,408,155 kWh	48.6% saving
Carbon Dioxide CO ₂ Emission Savings	142,013 Tonnes	77.4% saving
Nitrogen Oxides NO _x Emission Savings	439.0 Tonnes	76.6% saving
Sulphur Dioxide SO ₂ Emission Savings	1,480.84 Tonnes	90.9% saving
Water Consumption Savings	412,855,000 Litres	43.8% saving
Savings in Energy and Water Budgets	£5,388,721	31.36% saving

Notes:

1. The Council's target was to reduce energy consumption by 40% within 10 years from 1991/92 to 2000/01.
2. The above savings are for corporate property and housing stock, where the Council pays the energy and water bills, and exclude Council tenant and private sector savings achieved by the Housing Energy Efficiency and Sustainable Energy Programmes.

Fig.1

Climate Change Strategy for Woking 1 April 1991 to 31 March 2004

Reduction of CO ₂ Equivalent Emissions	17.23% saving
Electrical and Thermal Energy from Sustainable Sources	97.7%

Notes:

1. Woking's Environmental Footprint - 1,060,000 tonnes of CO₂ equivalent emissions at 1990 levels.
2. Target to reduce CO₂ equivalent emissions by 80% from 1990 levels by 2090 RCEP target.
3. Council targets to purchase 100% of its own electrical and thermal energy from local sustainable sources and 20% of its own electrical energy from local renewable sources by 2010.

Fig.2

Fire & Emergency Planning Authority and the London Development Agency, has very recently announced plans to generate renewable energy in London. This will be in the form of a decentralised system of local generation as an alternative to the centralised grid system designed to meet climate change objectives. The London Climate Change Agency, which is a component body of the London Development Agency, is the practical delivery agency implementing climate change projects in water, waste and transport. Energy will be delivered through an Energy Service Company (ESCO) in conjunction with EDF Energy. The Joint Venture Company Finance for this is split with a 20% Shareholding (19% Public Sector and 81% Private Sector Partner(s)) and with 80% Loan Finance.

The annual thermal efficiencies and grid losses for centralised power generation are presented in Fig 3 for comparison with Fig 4 showing the economic and environmental advantages which could be realised by the introduction of a highly decentralised energy plan for London in the first quarter of the 21st Century. An

inter-comparison of prices for Grid Supply and Private Wire supply shows the economic, environmental and engineering advantages to be gained from the use of private wire in preference to electricity supply from the Grid. Electricity would be delivered through a new London Energy Internet, by means of a series of Island Generation, private wire based sub-units, powered by CHP, Fuel Cell and PhotoVoltaic units, with connection, technical and supply (standby and top up) agreements with the Grid.

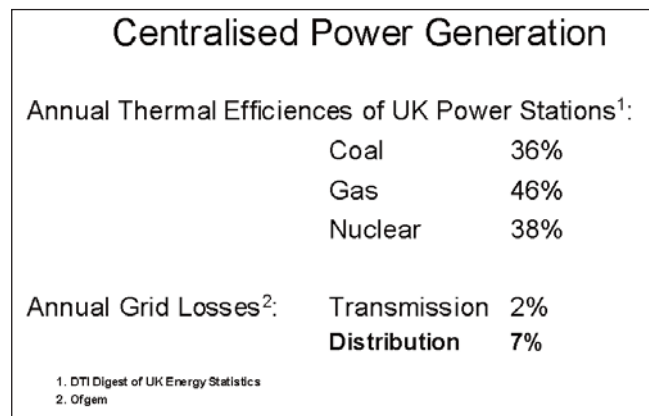


Fig.3

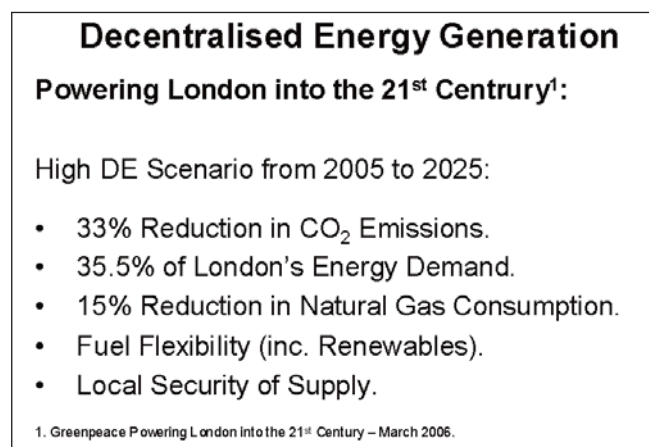


Fig.4

The Mayor's Energy Strategy for CO₂ and listing of Sustainable Energy Targets is summarised in Fig 5. The enormous potential for new renewable energy projects in London is summarised in Fig 6, and large scale renewable energy projects are listed in Fig.7. Hydrogen will be the energy carrier of the future, which will be manufactured locally from renewable sources (Fig 8). Fuel cells and the Hydrogen Economy derived from renewable fuels represent the only technology/fuel that can sustainably meet the UK's future electricity, thermal and transport energy needs. The current barriers to this are not technical but are regulatory and due to vested interests.

According to the London Development Agency's *Green Alchemy report – Turning Green to Gold*, "The potential sustainable energy market generated as a direct result of deploying the technologies set out in the Mayor's Energy Strategy could be worth around £3.35 billion by 2010 and employ between 5,000 and 7,500 people."

For further information see www.praseg.org.uk/downloads/2005/Allan%20Jones.pdf

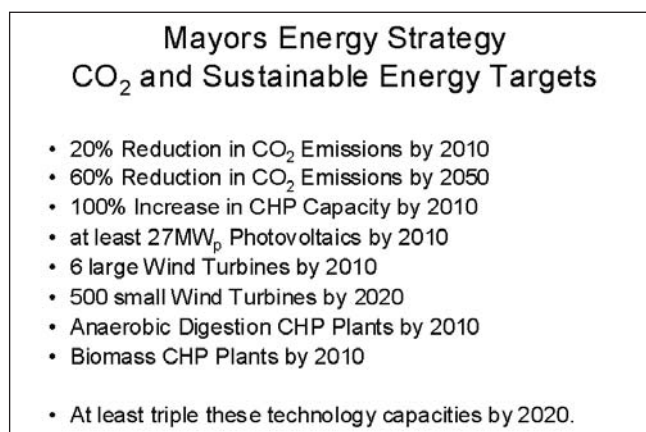


Fig.5

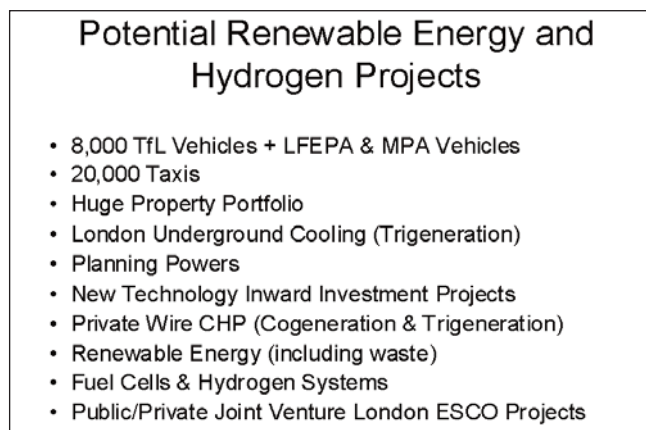


Fig.6

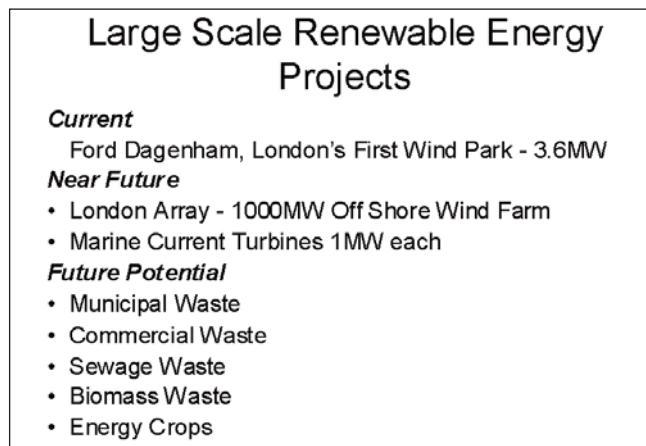


Fig.7

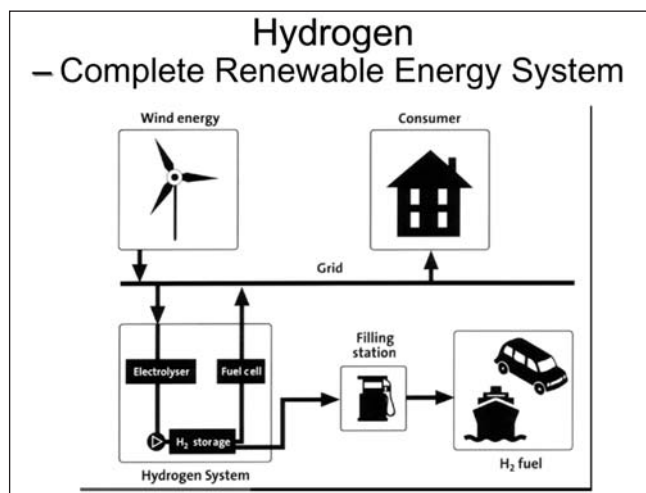


Fig.8

Must Nuclear make a Contribution?

Michael Connarty MP

Secretary, All Party Parliamentary Group on Nuclear Energy



I set myself five key questions: Is nuclear power necessary, safe, sustainable, affordable and is its use avoidable? This note sets out the results of my research on these questions.

Is Nuclear Power Generation Necessary?

Table 1 UK Electricity generation over Time				
	1998	2005	2010	2020
	%	%	%	%
Coal	36	34	25	15
Nuclear	29	20	15	7
Gas	28	41	45	55
Renewables	1	2	10	20
Oil	2	1	1	1
Hydro	2	1	1	1
Imports etc	1	1	3	1

Source: Energy White paper.
Department of Trade & Industry

Nuclear power provided 29% of the reliable 24/7 base-load electricity to the UK in 1998 and 20% in 2005 (Table 1). Under current plans, progressive reductions of nuclear power generation (see Fig 1) would be replaced by increases in gas imports and renewables. A survey of present progress leads me to doubt whether the realised increase in renewables will match nuclear's reliability in maintaining base-load electricity supply over the grid.

The shock of the interruption of the gas supply from Russia to the Ukraine in winter 2006, and the massive price rise in energy

products underline their position as an important consideration in Geopolitics. Reactions to Gazprom's interest in British Gas caused a stir and underlined increased concerns about security of energy supply. In an open and free international market, the result is likely to be reflected in price rather than a threat to supply, leading to a reappraisal of domestic sources such as nuclear power.

According to Tony Blair "the single biggest long-term problem we face as a world is the issue of climate change. The evidence is now overwhelming."

The Government has targets for reduction in CO₂ by 20% by 2010, and a cut of 60% by 2050 from 1990 levels. The 2010 target will not be met not least because of the

rise of 3.2 million tons of Carbon from electricity generation from 2000 to 2005. I suggest this is linked to the run-down of the non-CO₂ generating Magnox nuclear stations (see Fig 1).

Security of electricity supply without nuclear would therefore be subject to the following five factors:

- 1) Decline in domestic coal production and greater use and costs of imports;
- 2) Increasing reliance on imported gas, volatile in supply and price;
- 3) Increased use of CO₂-producing fuel cycles;
- 4) Greater reliance on alternative fuels and energy sources;
- 5) Substantial costs in developing renewable sources and carbon abatement processes.

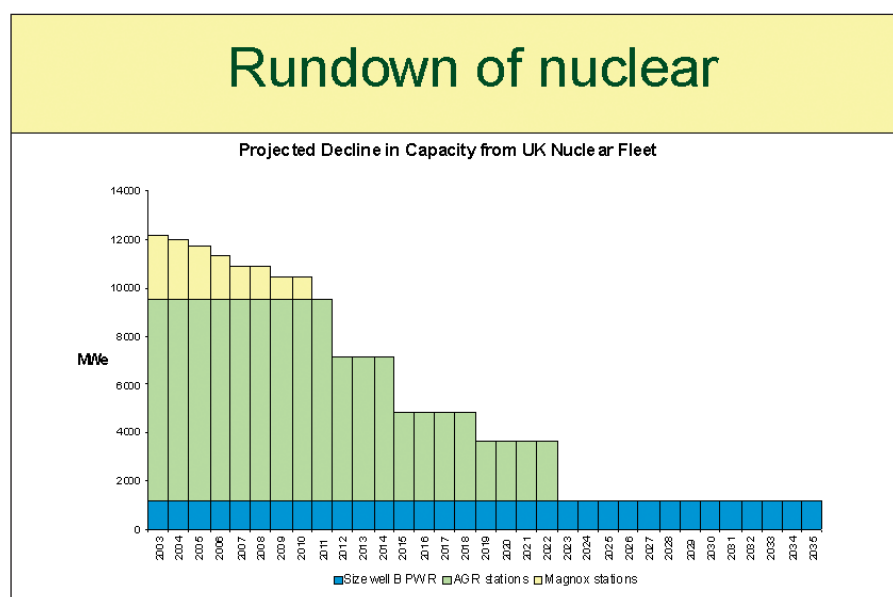


Fig.1

Nuclear is necessary if the UK is to maintain the diversity of supply choices to protect us from supply problems and the trend line for CO₂ production is to decrease over time.

Is Nuclear safe?

Greenpeace founder, Professor James Lovelock concluded "Nuclear electricity is now a well-tried and soundly engineered practice that is both safe and economic; ... even taking the Chernobyl disaster into account it is, according to a recent Swiss study, by far the safest of the Power industries." Extreme breaches of basic safety and design protocols at Chernobyl, discussed elsewhere in this issue, are unlikely to be replicated in a future setting, whereas the safety record of nuclear power generation is well known and easily verifiable.

The reality of spent nuclear rods giving off minimal amounts of radioactivity when only immersed in several metres of water, which I have personally verified, contradicts the "scary story" image of ticking time bombs of nuclear waste used as an image by the anti-nuclear power lobby. The issue of storage in the short, medium and long term is one for which a solution is long overdue, but has been exacerbated by indecision and inactivity on the part of UK Governments over the last forty years. It is not due to a lack of technical and scientific knowledge of how to store or dispose of waste nuclear materials in the UK. Geologists agree that Uranium ore deposits that are often more than two billion years old but which have no surface expression present an analogue for a safe high level nuclear waste repository. After forty years of inactivity, during which France, Finland and the USA have advanced their search for a solution, geological disposal is back on the list of possible options according to the UK Committee on Radioactive Waste Management (CoRWM). The Canadian study, led by a former UN Environmental Commissioner, Elizabeth Dowdeswell, suggests a way forward.

Is Nuclear Sustainable?

Known supplies of uranium ore reserves will suffice for 50-60 years at the current rate of use. Any increase in demand will tend to raise the economic value of these reserves and also, more importantly, the current value of future exploration for new reserves that will be required beyond 50 years. Canada and Australia have been joined by Russia and Kazakhstan as major sources. Non-coal fossil fuels are not thought to be sustainable for as long at the current rate of use. I agree with the Chemical Industries Association that such fuels should be reserved for their variable uses as chemicals and for new Hydrocarbon based products.

At present the energy output of one 8 gram pellet of uranium is the equivalent of 900m³ gas=700litres of oil=4000kg of coal, yet first use reactors only release 10% of a pellet's energy. Reprocessing and future fast breeder technologies could release up to 90% of pellet energy. Thorium, abundant in India, is an additional alternative to uranium which can be enriched to operate in Canadian CANDU reactors without producing uranium. Nuclear is sustainable.

Is It Affordable?

Just as scare stories are used about nuclear safety, so some exaggerated

sums have been set against the capital costs of nuclear power generation. One recent statement from an MP's anti-nuclear group stated £1,000 per Megawatt produced, which is just absolutely unfounded. The latest estimates are that FULL capital and running costs including decommissioning of new generation nuclear power stations will fall between £20 and £30 per megawatt generated.

The percentage of total cost are as follows:

Capital 17%

Financing 41%

Operations and Maintenance 25%

Fuel costs 13%

Spent Fuel Management 2%

Decommissioning 2%

To complete the analysis of costs I researched the comparative non capital generation costs per kilowatt hour of electricity for each fuel type. Since this analysis gave no indication of the level of CO₂ output for electricity generated, I researched the CO₂ output for each fuel.

Is Nuclear Avoidable?

From all the evidence I have found in my research I have to conclude that if Climate Change is to be tackled and the UK is to have the affordable, diverse and secure energy balance it requires for the coming century it must contain a

Costs & CO ₂ Output per kilowatt of Electricity for each fuel type		
	Pence per kWhour	Grams CO ₂ per kWhour
Wave	22.5	8
Tidal	13.5	8
Wind/offshore	7.0	8
Hydro	?	9
Biomass	6.5	17
Geothermal	?	79
Solar	?	133
Wind/onshore	5.2	8
Gas/OCGT	4.2	430
Diesel	?	772
Oil	?	818
Coal/IGCC	3.5	995
Nuclear	2.8	4
Gas CCGT	2.7	430
Coal/CFBC	2.4	955
Coal/PF	2.3	955

substantial nuclear power element. The public response to nuclear is changing as the survey of public opinion in November 2005 showed that 41% supported the building of

new nuclear stations to replace the existing ones. Perhaps people are already responding to the scientific arguments which clearly demonstrate that we already have

safe and secure CO₂-free nuclear power generation in abundance but will need to rely on new nuclear build on existing sites for base load electricity supply.

In discussion the following points were made:

A tidal energy bridge over the Severn Estuary with suspended vertical axis rotors would provide a cheaper, efficient and less environmentally damaging option than a barrage. Transmission of carbon dioxide derived from coal burning along pipelines following railway lines could be used to extend the life of the Brent oilfield. Competition in delivery times between carbon capture and storage (CCS) and clean coal technology (CCT) on the one hand and new nuclear build on the other favours the former mainly due to inaction subsequent to the Energy White Paper and a very long drawn out approvals procedure. New nuclear build is therefore no longer an option available to the Government to replace soon to be decommissioned nuclear stations that provide baseload electric power, whereas CCS and CCT are ready to go straight away. New nuclear build could be installed much more quickly on existing sites. Renewables are retail technologies suitable for small scale operation, they do not replace the need for large scale primary baseload energy. The imminent closure of currently operational nuclear, coal and oil-burning electrical generating plant will create an 18GW shortfall by 2015 for which the only possible replacement on the Government's current agenda is imported gas with all the potential risks to security of supply and cost that that entails.

The Importance of Clean Coal Technology

Anthony Darbyshire – Trustee, The Comino Foundation

The Comino Foundation's vision is that people in Britain should live more fulfilled lives within a prosperous and responsible society.

In pursuit of this vision the trustees have identified that the security, continuity, cost and cleanliness of electricity generation is of fundamental importance.

Currently UK electricity is generated using a balanced mix of fuels but, in the absence of a Government energy policy, it is predicted that the closure of ageing plants and market forces will alter this balance significantly. The nuclear and coal components will be replaced, progressively, by gas. Energy conservation and production from renewable sources will be a positive factor but will not address the fundamental problem of

Electricity generation by fuel type in the UK for 2003	
Gas	37%
Coal	35%
Nuclear	22%
Other	3%
Oil	1%
Hydro	1%
Net Imports	1%

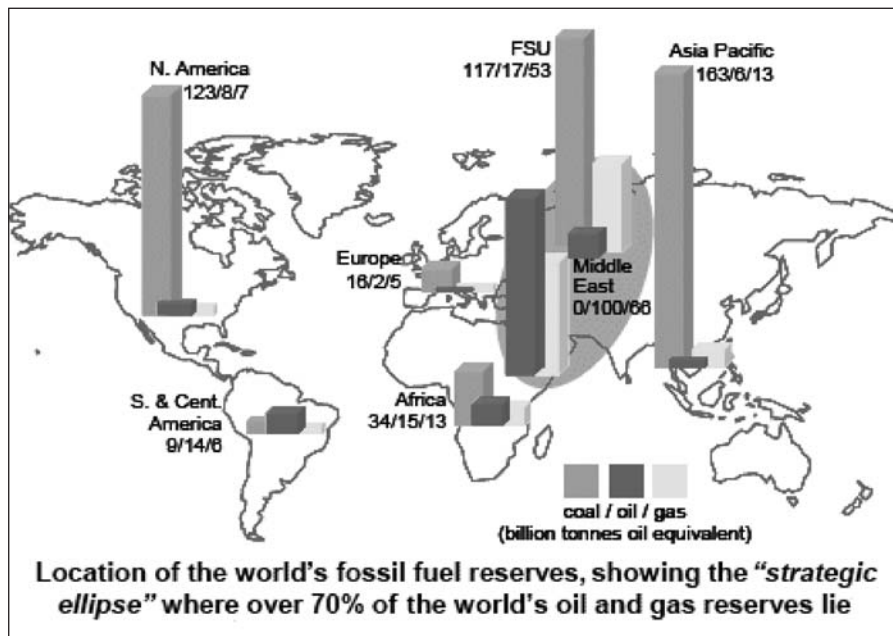
maintaining a strategic balance between gas, coal and nuclear fuels.

One possible scenario is that by 2020, 60% to 70% of UK electricity will be generated from gas with 80% being imported – a significant proportion from Russia. This would obviously be against the interests of the British people. To avoid this scenario the Government must establish a balanced energy policy for the 21st century.

The decision on whether to replace existing nuclear power plants is compounded by capital cost, safety, spent fuel disposal problems and a lead time for new stations of 15 years. The Government may be forced to support this option if it is not possible to maintain balanced energy generation using other means.

Having carefully reviewed this situation, Comino believe that the future, potential role of coal in generating electricity is not fully understood or recognised.

Coal is the most abundant fossil fuel in the world and in the UK. Security of supply and cost stability is better than that for gas. The key question to answer, however, is how CO₂ emissions from coal generation can be addressed to help curb global warming.



- encourage, with appropriate 'pump prime' funding, the development of one, or more, full scale demonstration plants;

The proximity of the UK's depleting offshore oil fields offers the opportunity to enhance UK oil output whilst providing substantial CO₂ storage. In the UK there is also extensive technical knowledge and commercial interest from private sector organisations. The opportunity exists for the UK to become a world leader in CCS technology.

BP and partners are planning a demonstration project to test the viability of linking onshore gas conversion, power generation and offshore CO₂ storage in Scotland. In March 2005 Powerfuel plc announced plans and funding to re-open Hatfield colliery in South Yorkshire and build a 430MW clean coal generating plant with zero emissions technology on this site. This new company is jointly owned by the Russian coal giant, Kuzbassrazrezugol (KRU) and Richard Budge, who led the buyout of British Coal.

To maintain their vision, the Comino Foundation urge the Government to retain coal as a major fuel in their forthcoming statement on energy policy and ensure that a new fleet of clean coal power stations can be built.

The technology to generate electricity from coal so that some, or all, of the carbon dioxide produced is eliminated, is well established.

Current technology to generate electricity with zero carbon emission requires that the CO₂ is captured and then stored underground, possibly to enhance the output of ageing oil fields. Existing coal power stations can also be modified to reduce carbon emissions in the medium term with upgrade to zero emission status at a later date.

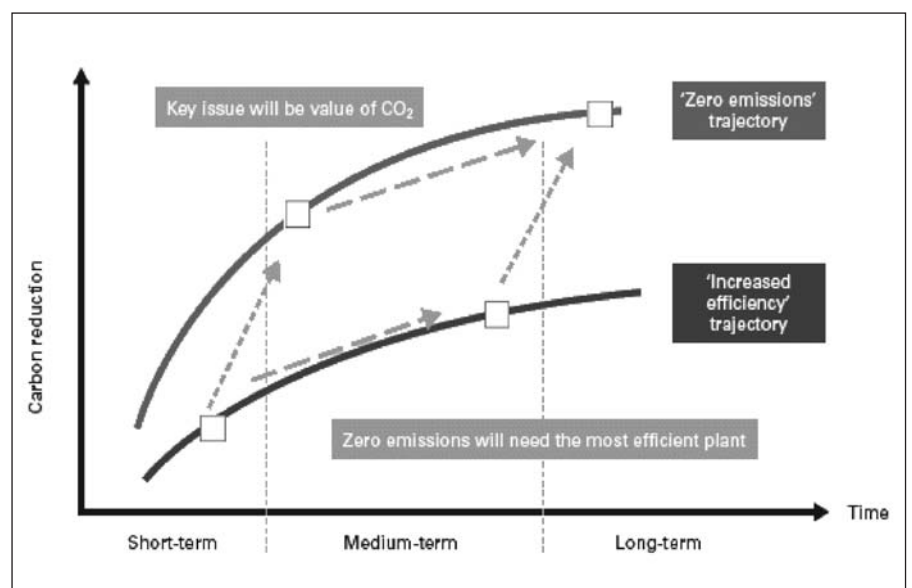
Zero emission plant with full carbon capture and storage (CCS) is operational in the US and the US Government is supporting further development. Many of the coal fired stations that are now being built in China and India have relatively efficient carbon reduction and may be upgraded in the future to be emission free.

In the UK, however, no firm progress has been made to establish electricity generation from clean coal technology. Some existing plants are reducing carbon emissions by introducing biomass to their fuel mix but modifying old, existing plants to introduce carbon capture is not considered a viable economic option.

The clear strategic option is to ensure that a new generation of coal fired power stations with CCS is built, progressively, to replace those that currently exist. This will maintain, and could increase, the proportion of electricity generated by coal. Fuel supply will be secure and cost will be competitive.

To realise this option the Government will need to:

- establish an energy policy which includes clean coal electricity generation with CCS as a major component;
- make necessary legislation changes to ensure that CCS is possible, commercially;



MEETING OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE ON MONDAY
22ND MAY 2006

In 2003 three criminal cases involved prosecution of mothers for causing the death of their babies, in which the mothers had suffered the loss of more than one infant. Police investigations relied on medical expertise and raised serious concern about the role of expert witnesses in court. The overriding issue is to prevent miscarriage of justice while protecting the interests and safety of children.

How will the outcome of these events affect the role and responsibilities of expert witnesses today and what changes to current legal and/or scientific practice, if any, will be required in future?

Science in Court: Expert Witnesses in the Dock

Baroness Kennedy of The Shaws QC



In most cases expert testimony is but one facet in multiple layers of evidence, but there are occasions when cases turn on expertise, including work I was involved in on Sudden Infant Death, following miscarriages of justice concerning Sally Clark's and Angela Cannings' convictions for killing their babies. Furthermore the General Medical Council (GMC) was reported by the Attorney General after a ruling that Professor Sir Roy Meadow should not have been struck off for giving mistaken evidence in Sally Clark's trial, since it had been decided in an earlier case that one cannot function as a doctor when performing as an expert witness.

The miscarriages of justice raised concerns about members of the medical profession, and the Royal College of Pathologists and the Royal College of Paediatrics, to their credit, took the initiative and asked me to lead an enquiry into ways in which they could prevent such miscarriages of justice happening again. We need to feel a sense of outrage that persons can be wrongly convicted and those cases touched on a raw nerve, especially the idea that someone might firstly lose their baby, and then be accused of having killed that child. However there are

carers and parents who cause children to suffer and do kill their offspring. So it is very important that we try to find ways of squaring that circle without putting liberty at risk. We also have to do justice to those who have no voice in our society and make sure children are well protected while making sure parents are not wrongly convicted. I sat on this Commission with paediatricians, a coroner, and a director of social services, with expertise in this field. Evidence was taken from Judges, and the Director of Public Prosecutions and we prepared a protocol which we hope will prevent these things happening in future and examined the role of the expert witness to understand how things might have gone wrong. Unfortunately doctors sometimes base their testimony on medical belief rather than scientific evidence. Good diagnosticians do have that feeling of something in their bones, but it is not good enough in a criminal court.

There are other temptations in the adversarial arena, pushing people into certainties where there are none with barristers for the Crown hating the words "I don't know", because you have to prove your case beyond reasonable doubt. As soon as the

witness you have called says "I don't know" or "it might be the proposition you are putting to me (this to the defence lawyer) is right," the defence can see the possibility of undermining the Crown case. There may be other evidence that comes before the Court that leads to a conviction on the case of beyond reasonable doubt, but very often witnesses are told that if you express any doubt at all you are presenting a gift to the other side.

But expert witnesses also find themselves in positions where a high level of certainty may be lacking and should be willing to make proper concessions. Expert witnesses are independent and they are not there to win the case for a side. Even if they are being called by the Crown or the defence, they don't belong to anybody. However, just as lawyers and judges can experience case-hardening, so can doctors and experts, particularly if they are always called by one side, and don't have that balancing experience of doing it for all sides. If you spend your life dealing with children who have been abused and see the horror of how this impacts, then maybe you start seeing it everywhere.

People say to me, "how can you defend somebody who you know is guilty?" It is for the Court, the judge and jury to decide whether they are guilty and my role is to give voice to my client's case and I'm not the person who is sitting in judgement. You also have to give some people a sense of how ridiculous their account might be, but as a lawyer it is not my duty to judge and in the same way the expert should say it is not their role to be the judge and jury. You have to be reliant on your expertise and to examine whether the evidence is compelling and whether it is supported scientifically, to express a view in criminal proceedings.

Doctors sometimes, through lack of training, fail to appreciate the difference between the roles of professional and expert witnesses when in the latter case they will be able to express an opinion, but basing their views on science. At other times doctors may appear in a professional capacity describing their treatment of a patient. The temptation is that people try to turn them into experts: for example, "While you're here reporting on the anatomical aspects of the post mortem you conducted, can I just ask you if somebody has a wound of that length do you think....?" The doctor is then being turned into an expert, having been called in a different capacity. It is very important for doctors to say, "I'm sorry but are you asking me in my role as the person who dealt with this particular case or are you asking me to turn myself into the expert in the case?" Judges should hold the reins on that and very often fail to do so.

The GP's evidence in family courts is subject to a different standard of proof. For example, in a child abuse case in the family court, the trial is a balance of probabilities and the court will make it clear that their first purpose, above all else, is the interest of the child. What is required of an expert there is different from that in a criminal court where the standard of proof is much higher and where liberty is an issue. Experts need to know those distinctions and the ways in which the courts have different sets of priorities and where a family court might say "on the balance of probabilities and with the help of experts we believe that a child may be at risk here and we will therefore

take this child away from its family" but that evidence would have been insufficient in the criminal court to punish on a criminal basis and send someone to prison.

We found that where there was failure by parents of babies who died, it was usually not due to criminal failure that should be dealt with by the criminal courts. It's not usually about people being wicked, but about the suitability of people as parents, or their capacity for parenting, possibly affected by drink or by drugs.

Experts are frequently called by the defence where babies have broken bones that are attributed to natural causes unrelated to abusive parental behaviour. The question is whether this has any scientific basis – were there peer reviews? Are there any scientific publications on the topic? Did those in the scientific and medical community have an opportunity to debate this matter? There has to be some control in the court from quacks and people presenting them as people with expertise.

A separation is required between carers and experts. It is incorrect for GPs with families in their care, or for a hospital paediatrician who receives a dead baby in an ambulance and has to speak to the family and has the trust of the family, to become experts in court. It is far better that someone new provides expertise, but very good records will have to be kept by all those who are involved professionally.

In the Sally Clark case a vital piece of scientific information was withheld from the defence – the presence of a staphylococcal infection in the lungs. It was felt that it would be elevated into something much more important than it should be and allow somebody that had killed a baby to get away with it. But then you are doing exactly what you are not supposed to do as an expert, you don't try to replace those who are judging the case.

The judge should have prior indication of agreement and disagreement between experts in cases with complex expert testimony, and highlight the issues which exist between the parties. If it is evenly balanced, with a case turning virtually exclusively on that evidence, the case should not proceed, because it would be

impossible to have a conviction, and it is wrong to expect a jury to make a judgement between two sets of expertise, when each is based on peer reviewed evidence, but perhaps one is based on newer information. Lord Steyn has said in the House of Lords, "It would be entirely wrong to deny to the law the advantages obtained from new techniques and advances in science."

It is important to ask the following: What is the expert doing in practice and is the expert still in practice?

When did he or she last see a case in his or her own clinical practice? To what extent is the witness an expert in the subject to which he or she testifies? Roy Meadow fell into error when roaming into statistics which was not his field of expertise. Judges should help witnesses clarify where they have expertise and where they do not, are they in good standing with their own College and up to date with continuing professional development? Has training in the role of the expert witness been undertaken in the last 5 years? To what extent is his or her view widely held? If it is not widely held, is the view still based on science, rather than something that is to a large extent conjecture? Judges should also be alert to the cosiness that develops in the courtroom because the same witnesses reappear frequently.

Our recommendations indicate that expert witnesses from outside the jurisdiction should be tested with the same rigour as British experts. The court cannot be the playing field of the retired or of those who present a new theory which has not been subject to scientific peer review. The bar has been set very high because of the miscarriages of justice concerning paediatrics leading to a dearth of pathologists or paediatricians. I heard the Attorney General saying that we should have them struck off if they get it wrong in the courts. I am not sure it was a very timely moment when we are trying to encourage people to stay in this field. It is important to have their expertise while making sure that they operate appropriately and rather than debarring doctors we should be providing them with better training, otherwise we will have courts without the expertise they require. We also need to train judges to be much more skilled and proactive in exercising their duty to establish the expertise of witnesses.

SCIENCE IN COURT – EXPERT WITNESSES IN THE DOCK

James Badenoch QC
Chairman, Expert Witness Institute

The role of the expert witness is currently under the spotlight as never before. This is the result of a few high profile recent cases; of certain actions of the General Medical Council; and of critical but often ill-informed media comment.

Part of the problem has been a lack of balance in the publicity attending the recent cases, due to failure, wilful or otherwise, to understand or report them correctly. In the Sally Clark trial, Prof Sir Roy Meadow wrongly strayed beyond his expert field of paediatrics by giving evidence for the Crown of the statistical improbability of two cot deaths occurring in the same family by chance alone. He misinterpreted the statistics, but there had been no prior enquiry by the prosecution into their validity, and the defence did not challenge them in cross-examination despite discernible fallacy. The trial judge told the jury to disregard them, and successive Courts of Appeal and the GMC expressly found that the professor had given the evidence in good faith. In fact, the pathologist who reported the post mortem findings, but who gave no expert opinion evidence, had failed to disclose to the prosecution the presence of bacteria in bodily samples. This omission of factual material (notwithstanding much evidence capable of pointing to guilt) was the ground upon which Mrs Clark's conviction was overturned.

Professor Southall was disciplined by the GMC for having voiced to police (not in the witness box) his expert opinion that Mr Clark's televised account of a spontaneous nosebleed in his infant son could not be true, and signified deliberate suffocation. In the case of Trupti Patel the mother was acquitted of murdering her babies, which is not an indictment of expert evidence. In the Angela Cannings case no expert erred or misled the court, but her

conviction was quashed on the ground that when reputable experts disagreed in court about the aetiology of fatal injuries (some of them allowing the possibility of natural causes) the jury could not, without other extraneous evidence proving guilt, safely be sure about it (though the jury had clearly thought otherwise).

The apparent effect of the Cannings decision, namely that opposing expert theories must necessarily neutralise the prosecution case, was swiftly modified in *R. v. Kai-Whitewind*, with the Court of Appeal holding that a dispute between experts about the interpretation of findings did not automatically extinguish those findings, which remained to be evaluated by the jury.

Yet these cases have quite unjustifiably engendered widespread vilification of expert witnesses generally, as a dangerous source of misleading evidence and a cause of avoidable injustice. This has produced a doubly malign effect:

Public perception of expert witnesses appears increasingly unfavourable, due in part to ignorance and/or misunderstanding, with consequent lessening of confidence in the justice system as a whole.

Experts are, by report, becoming increasingly reluctant to give evidence, for fear of unpleasant consequences, personal or professional (or both), particularly in child abuse and child protection cases, which adversely affects access to justice, and further endangers some of the most vulnerable in our society.

Ignorance of what exactly an expert witness is (I mean of what qualifies him to give opinion evidence) is depressingly apparent in the minds of the public, and of a few vociferous commentators. Expert witnesses are in the dock partly



because of the notion quite widely peddled and believed that they are a breed of plausible rogues, probably qualified only by white hair and gold-rimmed glasses, who style themselves expert witnesses and are willing in return for large fees to provide ostensibly learned opinions on any subject, with conclusions to suit their paymasters.

It is crucial that this demonisation, and its malign effects, are countered and reversed. We need to get across that an expert witness is an expert first (in his specialised field), and a witness (selected for his learning) second, and that there are very exacting standards imposed on expert witnesses by the law. We need to explain how huge is the number and variety of cases in which justice depends on expert evidence. Finally we need to restore the confidence of the experts themselves, by educating them in the requisite legal standards, and demonstrating that conscientious adherence to those standards will rightly protect them from public opprobrium, and from the threat of judicial sanction, and from professional discipline.

Media coverage promotes a general awareness of the contribution to criminal cases of fingerprint and scenes of crime experts, pathologists etc. Too few, however, understand how many other issues before the courts in a complex society are incapable of fair resolution, with the right remedy or outcome, without expert witnesses to supply understanding (which litigants, judges, tribunals and juries lack) of

technical matters which are central to the case.

The following is a random list of subjects requiring expert evidence, some commonly. It covers only a fraction of these instances, but is instructive:

- the allegedly faulty radar gun or speed camera;
- the adequacy of the guard on a factory machine;
- the state of the brakes on a runaway lorry;
- the indications for urgent Caesarean Section;
- the mechanisms of brain damage in a foetus;
- mental capacity when a will was changed;
- the cause of an aircraft crash, bridge collapse, or wall subsidence;
- disputed paternity;
- the cause, extent and effects of bodily or psychiatric injury;
- the measurement of aircraft noise;
- vehicle speeds before a collision;
- the best interests of young children.

Every day across the land courts rely on expert evidence on topics like these to decide the just attribution of criminal or civil liability. "Expert witnesses are a crucial resource", said the eminent judge Dame Elizabeth Butler-Sloss, "without them we [the judges] could not do our job".

What the law in broad terms asks of the expert is:

- that he has the relevant expertise, and does not stray outside it;
- that he reaches his opinion on adequate grounds, after diligent enquiry;
- that his opinion is honest, uninfluenced by the interests of the parties;
- that he is prepared to change or modify his opinion if good reason is shown, and does not adhere stubbornly to a position for the fact alone that it favours the side which enlisted him.

These principles, amplified and extended, are enshrined in Part 35 of the Civil Procedure Rules 1998 and in the Practice Direction which supplements it. This Practice Direction repays study, and is printed on page 32. The new Criminal Procedure Rules, whose introduction is imminent, will largely echo the civil ones.

Do expert witnesses unfailingly meet these standards? The answer today is that they do in the vast majority of cases, but not always. In *Phillips v. Symes* [2004] EWHC 2330 (Ch), a case founded on psychiatric evidence of mental capacity, Mr Justice Peter Smith ruled that an expert witness could be condemned personally in wasted litigation costs if, by his evidence, "he causes significant expense to be incurred, and does so in frequent divergence from his duties to the Court". In *Pearce v. Ove Arup Partnership Ltd* [2002] IPD 25011, Mr Justice Jacob (as he then was) referred an expert witness to his professional body for consideration of disciplinary proceedings, for having given "biased and irrational" evidence to the Court. [I understand the professional body took no action].

As for truly impartial detachment from the enlisting party's interests, things are more difficult. In my principal field of legal practice, clinical negligence, it is noticeable that experts of matching experience and distinction are very often found, on identical facts, to take diametrically opposite views for the Claimant and for the Defendant, and with apparently equal conviction and sincerity. At the 2005 annual conference of the Expert Witness Institute the Master of the Rolls, Sir Anthony Clarke said this:

"I have listened to many experts giving evidence, and there have been times when I have wondered what they would have said if they had been instructed by the other side instead.....It seems to me that there is at least a risk that a person who is asked to express an opinion by a party to litigation, however much they try to be entirely objective, will tend to [bend] their opinion in the interest of the client, at least in the grey areas – which appear in almost every case. It is inevitable – it is human nature".

We cannot change human nature, but lawyers must be mindful of it. The Master of the Rolls pondered the solution of requiring experts to report without first being told from which side of the dispute their instructions came. Certainly the lawyers have a clear duty to ensure when preparing cases that expert evidence is soundly based, and that experts have considered the merits

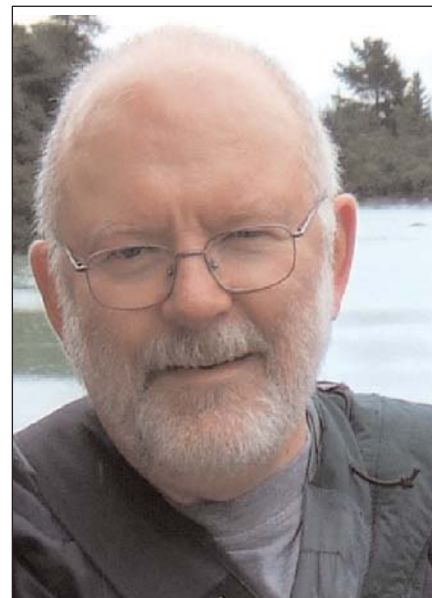
of contrary arguments and tested their own against them, before their reports are served and before they are called to the witness box. This discipline may not be universally followed, but it should be, and training in these principles for lawyers and experts alike is already a priority.

These concerns notwithstanding, it is the fact that in every contested case where expert evidence is in issue under our adversarial system, there will by definition be differing opinions expressed on either side. In the criminal court the jury may be left unsure of the correctness of one opinion or the other. In the civil court the judge must decide which of the two should prevail, always of course with the unscientific luxury of determining the issue "on the balance of probabilities". In either case the effect of the verdict or judgement is that one of them is probably wrong, or at least not provenly right. Yet at the end of these cases we do not expect a hue and cry, or allegations that the expert whose opinion has been rejected has acted dishonestly, improperly or culpably. For in all specialist disciplines there are difficult areas where expert views may differ markedly on grounds which are at least arguable, and are advanced with complete sincerity.

To restore the willingness of experts to offer their skills to the courts, and to protect this crucial resource of justice from further erosion is an essential goal. To do this we must make sure, and make clear, that provided the expert witness does his conscientious best to comply with the requirements of the Rules, it cannot and will not be a ground for legal, professional or lay complaint that his opinion is held to be wrong, or is for whatever reason rejected, disregarded or not preferred. Provided the opinion is honestly held, is not outwith his expertise, and is impartially presented after appropriate and diligent investigation, the expert witness has done his duty, and done it properly. That he should continue to be willing to do so, and that public understanding of the importance and value of expert evidence should be enhanced, is vital to justice, and to the confidence all need to feel in the justice system.

SCIENCE IN COURT – EXPERT WITNESSES IN THE DOCK

Professor Robert Forrest LLM, FRCP, FRCPath, CChem, FRSC, President, Forensic Science Society, Honorary Professor of Forensic Chemistry, University of Sheffield



Expert witnesses have long been subject to criticism both within and outwith courts. 150 years ago, on 22nd May 1856, the trial of William Palmer at the Central Criminal Court was reaching its conclusion as expert evidence for the defence was being adduced. Dr William Palmer was a member of the Royal College of Surgeons who practiced in Rugeley, in the Black Country. He enjoyed the life of the turf spending more time on his string of racehorses than on his practice. Suspicious deaths had clustered around him from the time he had been a student. The death that led to his trial for Murder at the Old Bailey was that of his friend John Parsons Cook who died in convulsions under his treatment. Strychnine poisoning was suspected and viscera collected at a post mortem examination organised by Cook's stepfather was submitted to Dr Alfred Swaine Taylor, at that time England's leading Toxicologist. When Dr Taylor received the samples there was evidence that they had been interfered with and Strychnine could not be detected. The evidence presented at Dr Palmer's trial was largely circumstantial and with a broad leavening of opinion evidence. Expert evidence centered around the detectability, or lack of detectability, of Strychnine at post mortem examination of humans and

animals who had died of Strychnine poisoning and alternate explanations for Cook's death such as Tetanus or Hysteria. Amongst the great and the good giving evidence for the Crown were Sir Robert Christianson, Sir Benjamin Brodie and Dr Alfred Swaine Taylor himself.

During the course of his trial, Palmer passed a note to his Counsel stating:

"I wish there was 2½ grains of Strychnine in old Campbell's (the Judge) acidulated draft solely because I think he acts unfairly."

The trial lasted for twelve days and the jury returned a Guilty verdict after retiring for 1 hour and 18 minutes. Dr Palmer was sentenced to death.

If he had been found "Not Guilty" he would have immediately been charged with the murder of his wife, Annie Palmer, whose body had been exhumed and had been found to contain large amounts of antimony.

There are many lessons for today in the trial of Dr Palmer.

Palmer exhibited a considerable amount of dysfunctional behaviour as a student, a factor which is not uncommon among doctors and nurses who systematically kill their patients today;

there were a large number of deaths before the penny dropped;

there was a mass of circumstantial evidence against Palmer;

the forensic evidence was sparse and controversial;

there appears to have been some difficulty in obtaining expert evidence for the Defence;

there was a clear conflict of expert evidence and a demarcation in those giving the evidence.

Experts from London and Edinburgh appeared for the Prosecution and from the provinces (including Dublin) for the Defence.

There was an extra-curial campaign orchestrated by friends of the Defendant; for example, a journalist obtained an interview with Dr Taylor and what Dr Taylor claimed were false pretences and comments made by Dr Taylor at the interview were used in his cross examination.

There were allegations of interference with the physical evidence.

Controversy continues 150 years after the trial and Palmer's execution.

150 years later, on 18th April 2006, an article appeared in *The Times* by Phil Willis MP under the somewhat provocative title "*There'll be no playing to the Court thank you Professor*". (I appreciate that this title may have been applied to the article by a sub-editor).

Willis raises a number of interesting points in his article; taking the title

first, it will be abundantly clear to this audience that the native ability of an individual to present complex concepts in Court and elsewhere varies. The ability to present complex information accurately so that the average man can understand it is, or ought to be, part of the stock in trade of a politician. The problem arises when this skill is used in a biased and unfair way. As far as presenting expert evidence, or indeed any evidence in court is concerned, training can help to level the playing field but will not totally flatten it. I would certainly favour mandatory training in court procedure and the presentation of evidence in court before a court accepts an individual as an expert, that is to say, someone giving opinion evidence. Obviously there have to be exceptions which I think could safely left to the discretion of the court.

This brings up the question of recognition as an expert by the court. Some argue that it is one step from registration as an expert by some formal body as a prerequisite for giving opinion evidence to the system of court registered experts used in the Civil (Roman) Law systems. This system does have some advantages, perhaps more for the prosecution than the defence. One obvious disadvantage is that the court will choose an expert for a “*counter analysis*” when the defence wishes to challenge scientific evidence. The Defendant may not have access to the physical evidence and, in many jurisdictions, cannot influence the choice of the expert.

In my experience, experts from Civil Law jurisdictions do not fare well when they come to the United Kingdom and give evidence in an adversarial setting in the Criminal Courts. It is certainly arguable that court appointed experts in the Criminal Courts could weaken the ability of a Defendant to call whoever he wishes to give pertinent expert evidence in his defence. Court appointed experts need to be

clearly differentiated from experts recognised by the court.

There are advantages for the expert in systems where there is formal recognition (or appointment) as an expert by the court. Not least might be the issuing of an identity card recognised by Court Security Officers which allows one to carry the tools of one’s trade, such as calculators, laptop computers, dictating machines etc into the court building. One of my most humiliating experiences when assisting the court as an expert (at the request of the Prosecution) was having every piece of electronic equipment in my possession, except my watch, removed from me on entry to the Victoria Magistrates Court in Birmingham, including a calculator lovingly programmed with a series of “what if” scenarios that I expected to be put to me when giving evidence. When I remonstrated I was rewarded with a pat down in public by a Security Officer of the opposite sex. Fortunately, as there is no taxi rank rule for expert witnesses such issues are easily addressed; one can decline to accept instructions to appear in courts which adopt such policies. One problem of court appointed experts is that one can become part of a cosy little club with the potential for opinion evidence not being subject to the vigorous scrutiny that it would be in an adversarial system. Finally, there is the possibility of the court appointed expert being able to hide behind instructions issued by the examining magistrate rather than carrying out a “full and fearless” examination of the evidence.

The question of the disciplining of experts arises. Personally, if present, I would far rather be judged by Judges than a General Medical Council or Council for the Registration of Forensic Practitioners Disciplinary Committee or, as Phil Willis suggests, by the Criminal Cases Review Commission in respect of

any allegation of incompetence of malfeasance in the presentation of evidence. Many medical practitioners have lost faith in the ability of the General Medical Council to competently and fairly assess alleged incompetence or malfeasance by a medical practitioner assisting the courts as an expert. I, for one, would be much happier to be judged in those circumstances by a High Court Judge, perhaps assisted by an appropriate assessor.

One comment made by Phil Willis in his article was:

“Judges are not well placed to determine the validity of new scientific techniques or theories. An agreed protocol for validation should be introduced, as in the US.”

Whilst recognising that the United States is not a uniform jurisdiction, the Federal Rules of Evidence, in particular Rule 702, does provide a template which, interpreted in the light of cases such as *Daubert* for scientific evidence and *Kumho Tire* for technical evidence certainly provides a useful precedent that law makers could consider if a statutory protocol for the introduction of scientific or technical evidence in the Criminal Courts were to be introduced.

Nonetheless, such a protocol would still require Judges and Advocates to have a considerable degree of scientific insight if they were to assess appropriately the evidence which it was proposed to lay before the trier of fact. I would suggest that if such a protocol were to be introduced, then there would be need to increase the budget of the Judicial Studies Board for Judges and to consider introducing more training, with mandatory continuing professional development, in scientific evidence and opinion evidence based on scientific evidence for Advocates and pupils.

As a really long shot, I would suggest that it might be appropriate to make Law a post graduate subject, as in the United States, with

appropriate funding to encourage the entry of science graduates to the legal profession. For what it is worth, I would advocate the same

for medical practitioners. I believe that 18 is too young to start training in either Law or Medicine. Further, a return to the rigorous study of

basic science as the foundation for a medical education may, in the long run, improve the quality of opinion evidence from medical practitioners.

In discussion the following points were made:

Our system is adversarial resulting in polarisation of testimony. Expert testimony could be brought together to benefit all parties. In Singapore, witness conferencing results in evidence being presented together. A register of expert witnesses is not desirable since the variety in the criteria for experts in medical practice, for example, is so vast. Freedom of the individual is important. The following should be actioned: better training of judges and lawyers, very few of whom are scientists; no cosy group relations should be permitted between expert witnesses and judges due to frequent meetings in court; experts should be placed together to establish where they agree or disagree and the differences should be highlighted for the benefit of the court. Counsel from each side should co-operate in this activity. Expert witnesses should rely on sound science rather than authority as the basis for a professional opinion. The resources of the Royal Colleges should be deployed to assist in selection of expert witnesses, in preference to the development of a register. Postgraduate training for doctors and lawyers recommended, with up to four years' training after a first degree in science, though funds for this training do not exist. In general US students are better equipped than their UK counterparts. On the other hand, no special training is required for expert witnesses other than the simple requirement to tell the truth.

Appendix to talk by James Badenoch QC

PRACTICE DIRECTION ON EXPERT EVIDENCE SUPPLEMENTAL TO PART 35 OF THE CIVIL PROCEDURE RULES

Expert Evidence – General Requirements

- 1.1 It is the duty of an expert to help the Court on matters within his own expertise: rule 35.3(1). This duty is paramount and overrides any obligations to the person from whom the expert has received instructions or by whom he is paid: rule 35.3(2).
- 1.2 Expert evidence should be the independent product of the expert uninfluenced by the pressures of litigation.
- 1.3 An expert should assist the Court by providing objective, unbiased opinion on matters within his expertise, and should not assume the role of an advocate.
- 1.4 An expert should consider all material facts, including those which might detract from his opinion.
- 1.5 An expert should make it clear:
 - (a) when a question or issue falls outside his expertise; and
 - (b) when he is not able to reach a definite opinion, for example because he has insufficient information.

- 1.6 If, after producing a report, an expert changes his view on any material matter, such change of view should be communicated to all the parties without delay, and when appropriate to the Court.

Form And Content Of Expert's Report

- 2.1 An expert's report should be addressed to the Court and not to the party from whom the expert has received his instructions.
- 2.2 An expert's report must:
 - (1) give details of the expert's qualifications;
 - (2) give details of any literature or other material on which the expert has relied in making the report;
 - (3) contain a statement setting out the substance of all facts and instructions given to the expert which are material to the opinions expressed in the report or upon which those opinions are based;
 - (4) make clear which of the facts stated in the report are within the expert's own knowledge;
 - (5) say who carried out any examination, measurement, test or experiment which the expert has used for the report, give the qualifications of that person,

and say whether or not the test or experiment has been carried out under the expert's supervision;

- (6) where there is a range of opinion on the matters dealt with in the report:
 - (a) summarise the range of opinion, and
 - (b) give reasons for his opinion;
 - (7) contain a summary of the conclusions reached;
 - (8) if the expert is not able to give his opinion without qualification, state the qualification; and
 - (9) contain a statement that the expert understands his duty to the Court, and has compiled and will continue to comply with that duty.
- 2.3 An expert's report must be verified by a statement of truth as well as containing the statements required in paragraphs 2.2(8) and (9) above.
 - 2.4 The form of the statement of truth is as follows:

"I confirm that insofar as the facts stated in my report are within my own knowledge I have made clear which they are and I believe them to be true, and that the opinions I have expressed represent my true and complete professional opinion."

UK-China Partners in Science

David Concar, Science and Innovation Counsellor, British Embassy Beijing

In a spacious new building on the outskirts of Beijing a Chinese start-up company called CapitalBio is developing tiny devices, or chips, capable of reading the activities of thousands of human genes at a time. Better tests for monitoring tumours are just one of their many uses.

Next door, in China's new National Institute of Biological Sciences, more than a dozen government-funded teams are doing basic research in molecular and cell biology. The scientists leading them were all recruited from top US institutions.

A few kilometres away stands a gleaming multi-million dollar nanoscience centre funded by a Taiwanese microchip manufacturer. It has obtained scores of international patents on carbon nanotube materials in the past two years.

All this in a country that just 25 years ago was still emerging from political chaos and economic destitution.

Over the past few years China's overall R&D spend has been increasing by 20 per cent or more a year, outstripping the spending increases of all leading science nations. But how innovative and productive is China's growing R&D base? What are the emerging challenges and opportunities for established scientific countries like the UK? And how can R&D-based companies and organisations in the UK best position themselves to respond?

These are the key questions driving the work of the FCO's Science and Innovation network in China. Our staff are based not just in Beijing but also in Shanghai, Guangzhou in southern China and Chongqing in southwest China. The context we work in is that in a globalised world the UK's share of global R&D will inevitably diminish as China and other emerging economies increase their R&D output. A strong capacity

to collaborate with and access science and innovation in these countries will therefore become increasingly important if the UK is to remain a leading science nation capable of attracting inward R&D investment.

The S&I network in China is working with the Office of Science and Innovation, the research councils and other partner organisations in the UK and China to put in place the right channels and mechanisms for collaboration. In January 2005 we began a programme of missions, workshops, visits and media activities called *UK-China Partners in Science*. We have so far facilitated 70 activities involving close to 650 participants from the UK and more than 4300 from China.

The outcomes are encouraging. All six of the UK's natural science research councils are developing new or stronger ties with Chinese organisations. For example, the Council for the Central Laboratory of the Research Councils signed an agreement with the Chinese Academy of Sciences on laser science. And the UK's Medical Research Council signed agreements with three Chinese research organisations including the Chinese Academy of Medical Sciences covering areas such as stem cells, infectious disease and health research.

Updating Chinese perceptions of UK science and innovation is an important part of our work. The UK's historical contribution to science through the likes of Newton and Darwin is well known in China. But the UK's modern science strengths, its chip designers, expertise in climate change and high-tech clusters need and deserve a higher profile. We are building this profile by ensuring Chinese journalists get access to high-grade UK experts. Through *UK-China Partners in Science* we generated more than 500 print and website clippings and more than 50 TV

mentions as well as a novel UK-China science journalism awards scheme.

To function effectively as a facilitator the China S&I network also needs to provide UK scientists and policymakers with credible and informed access to the Chinese innovation system. Many leading figures from UK science including Sir David King, Sir Keith O'Nions, John Wood of the CCLRC and Colin Blakemore of the MRC have strong links with China going back many years or decades – as indeed does the UK's Science and Innovation Minister Lord Sainsbury. But over the past year we have assisted these and other opinion leaders to update and sharpen their knowledge and contacts through targeted visit programmes and high-ranking calls.

We are already working with our UK partners to build on the achievements of the past 18 months. A new phase of *UK-China Partners in Science* will soon be under way with funding from the OSI and FCO and focusing on six priority themes: clean and renewable energy; climate change, environment and sustainable development; infectious disease; biomedicine and the modernisation of traditional medicines; nanoscience; and space technology. A network of UK experts in these fields will assist us in driving collaboration forward.

We are in addition working with a consortium of UK universities and the Higher Education Innovation Fund to establish a joint UK-China innovation fund for supporting joint research with commercial potential. The work that has gone into developing institutional links over the past couple of years combined with the vital importance of China to global issues such as climate change and pandemic influenza make it a good moment to consider this and other forms of targeted funding of collaborative research with the world's most populous country.

Chernobyl – Catastrophe and Consequences

Jim Smith and Nicholas A Beresford

Springer and Praxis Publishing, UK ISBN 3 540 23866 2

The 20th anniversary of this momentous event has predictably given rise to a very broad spectrum of opinion and comment, varying from what Sir Bernard Ingham has described as “Chernobylitis – an inevitable festival of scaremongering, exaggeration and emotion” – to a formidable variety of attempts to state and analyse the facts behind what Smith and Beresford describe accurately in their title to this remarkable book.

It was my privilege as a young man in the 1950's to visit both Hiroshima and Nagasaki and in my later Parliamentary career to take a Select Committee to Three Mile Island. In the history of the 20th Century these events will undoubtedly be judged by its historians as examples of mankind's willingness to put civilisation at the risk of unpredictable consequences of unfettered science and its technological consequences. At the other end of the spectrum of opinion will be those who argue that, against the immense actual and potential contribution of nuclear power to our demand for energy, the catastrophe of Chernobyl must be judged in the context of a century in which human folly and stupidity undoubtedly cost tens of millions of lives.

The current media reports on the disaster reflect the broad spectrum of views on this event in particular and nuclear power in general. The view which may broadly be described as “green” propagates the opinion that Chernobyl was responsible for hundreds of thousands of deaths, many of which have still to occur. At the other end of the spectrum the IAEA, doubtless described as an “interested party” by its critics, suggests that “a reasonable central estimate is about 400 fatal radiation induced cancers during the lifetime of the 600,000 most highly exposed individuals and perhaps another 5,000 in more peripheral populations.”

The IAEA article concludes that: “While any such estimates have some ‘uncertainty’, the current findings are compatible with the risk estimates derived from Japan and clearly rule out the claims of ‘hundreds of thousands’ deaths made by some anti-nuclear groups.”

The number of actual deaths attributable without doubt to the disaster is, in fact, under one hundred.

But where, in this profoundly important controversy, does Smith and Beresford's important book fall? I would suggest that this is for each reader to judge. But I know of no more comprehensive, thorough or authoritative study of this topic or one which is demonstrably free from bias. It contains major contributions from three Russian, three Belarian, and one Ukraine, two Norwegian, one Swedish, three UK and one Austrian citizen. The volume contains some 71 charts and 82 tables. The text is complex and demands more than a modest familiarity with nuclear terminology, statistics and diagrams. Acronyms abound, as usual, but what is of outstanding interest is the range of scientific

investigations which have been undertaken and effectively summarised. These cover radiation exposures generally, radiation fallout and environmental transfer, radioactivity in both terrestrial and aquatic systems, wildlife health consequences and social and economic effects. Each chapter is followed by a list of references which reveals the astonishing range of investigations and publications to which this event has given rise.

The authors' summary and conclusions at the end of this profound and authoritative analysis are worth reading in themselves, even if the earlier material proves somewhat daunting for those who seek to extract from this disaster views for or against mankind's future dependence on nuclear power.

One of these is of particular interest: “Perhaps the largest impact of the accident on the ecology of the Chernobyl exclusion zone was brought about by the removal of the human population. Consequently activities such as agricultural production and the associated usages of herbicides, pesticides and fertilisers ceased. As a result floral and faunal biodiversity and abundance increased considerably.”

The authors concluded that: “The net positive effect of removing humans from the exclusion zone therefore appears to exceed the negative impacts of radiation.”

In their masterly summary they reach two further conclusions which seem of particular relevance to the current debate. The first is that “in many cases the mistakes made in response to the accident could be attributed not to a lack of knowledge in the scientific literature, but (for many complex reasons) to an ineffective distribution of this knowledge both within the scientific community itself and to decision makers and the general public.” This would seem to have a special relevance to readers of this Journal.

The second conclusion is that “apart from less than 100 deaths which have been linked directly to radiation, the actual number of deaths attributable to Chernobyl is *not known accurately, and probably never will be*” (italics mine).

Finally the authors conclude that in coming decades “nuclear power will form an important (and probably increasing) role in global electricity generation” and that “if another Chernobyl is to be avoided, governments, scientists and the nuclear industry must not forget the lessons learnt in the years since 1986.”

The authors have, in my judgement, performed an outstanding service to humanity in assembling and publishing the facts which sustain their conclusions in this volume. They have effectively demolished any excuse for publishing nonsense on the topic of nuclear power, its challenges, risks and rewards.

Sir Ian Lloyd

What is the cost of Climate Change?

Robert Freer

Climate change has moved up the agenda of politicians and their advisers to such an extent that the Government's Chief Scientific Adviser, Sir David King, recently described it as a problem "more serious even than the threat of terrorism"¹.

Professor Tyndall working at the Royal Institution in London was the first to measure the warming effects of atmospheric gases in 1861 and since then scientists have been measuring the surface temperature of the earth and, over a shorter period of time, the concentration of CO₂ and other greenhouse gases in the atmosphere which they believe to be responsible for the increasing surface temperature. From this information predictions are being made, using computer models, about the effects in the future of any further rise in temperature. Some of these predictions are worrying. Global changes in rainfall patterns and rising sea levels may create major new problems for those responsible for building and maintaining the national infrastructure.

The political response to this perceived problem has been to encourage the development of some selected technologies to try to reduce the man-made CO₂ emissions from electricity generation, industry and transport. Less attention appears to have been paid to the role of economic policy instruments in controlling emissions, and as a result the economic instruments and subsidies the Government has used so far may not be very effective. For instance, the wind farms which the Government has encouraged developers to build provide only 0.6% of our national electricity demand but it has been estimated that "the subsidy for wind power until 2020 will be some £30 billion.... enough for 1200 brand new city academies". To do this the Government has been using a "source of funds not subject to Treasury scrutiny" and it is "an irrational policy"². These figures suggest that the price per tonne of carbon reduction by relying on wind energy is an order of magnitude higher than the commercially traded rate for carbon in Europe.

Also the Government emphasis on mitigation appears to have overshadowed the alternative consideration of adaptation to climate change which may be a better choice economically.

It was to try to address the economic problems arising from climate change that the House of Lords Select Committee on Economic Affairs invited evidence and prepared a report on the "Economics of Climate Change"³.

It is encouraging that this report starts at the beginning by examining the publications of the Intergovernmental Panel on Climate Change (IPCC). These are relevant because the content of the Government's Energy White Paper and the subsequent Energy Bill were prepared in response to the IPCC forecasts on climate change.

The IPCC was set up by the UN in 1988 to address anthropogenic climate change and reported in 1990. It was followed by the Earth Summit at Rio de Janeiro in 1992. A second report in 1995 was followed by the Kyoto conference in 1997 which saw the agreement of the Kyoto Protocol to control emissions in order to reduce the prospect of global warming.

The Select Committee clearly thought that the IPCC has more work to do before its predictions could be a reliable guide for future decisions. In general they were concerned that the IPCC had not explored as rigorously as they should have done the links between projected economic change in the world economy and climate change, nor for instance the positive aspects of global warming and said "the Government should press the IPCC to reflect in a more balanced way the costs and benefits of climate change". The Committee also raised serious questions about the IPCC emissions scenarios which apparently did not include recent emissions experience in their short term projections. The balance of the evidence the Committee received suggested that the high emissions scenarios contained some questionable assumptions and outcomes and they considered that a reappraisal of the IPCC's scenarios exercise is urgently needed.

More fundamentally, and more worryingly, the Committee said "we have some concerns about the objectivity of the IPCC process, with some of its emissions scenarios and summary documentation apparently influenced by political considerations". Although there is among scientists a majority view on climate change there are also some dissenting opinions on the grounds that their computer model predicts higher temperature rises than have been observed in the historic past. The Committee was concerned that the dissenting voices were not always given a full hearing. They also observed that there might be political interference in the nomination of scientists to the IPCC and they were concerned that in at least one instance an experienced scientist was rejected for membership apparently because he did not pursue the consensus line. They considered consensus was not a necessary criterion for

membership of the IPCC “Consensus is the stuff of politics, not science”. The Committee made the recommendation that when members of the IPCC are being selected the nominees’ credentials should rely solely on their scientific qualifications for the tasks involved.

The Committee recognised the practical point that regardless of what action we take now the time lag in the climate system is such that global warming will continue. And since there is a risk that international negotiations will not secure large scale and effective mitigation action a more balanced approach to the relative merits of adaptation and mitigation is needed, with far more attention being paid to adaptation measures. The economic and social returns from investing in adaptation should be properly weighed against the cost of mitigation.

Looking at the specific problem of electricity generation the Committee considered that UK energy policy has focused too much on mitigation and appears to be based on dubious assumptions about the role of renewable energy and energy efficiency. They questioned the basis of the energy and climate policy which appeared to rest on a debatable model of the energy-economic system and dubious assumptions about the cost of meeting the CO₂ reductions.

The cost to the UK of achieving its objectives had been poorly documented and not clearly presented to the public. In saying “we look to the Government, with much stronger Treasury involvement, to review and substantiate the cost estimates and to convey them in transparent form to the public,” the Committee is apparently expecting the Government to undertake a stronger technical and financial scrutiny of the effect of the Government’s subsidies, and for the Government to ensure better communication with the public to explain the problem of responding to climate change and the costs they will have to pay.

The Committee drew attention to the fact there are available a number of low carbon methods of generating electricity and they expressed their surprise that the Government’s *Energy White Paper* should have placed such emphasis on just one technology, wind energy. The Committee did not recommend any particular choice of energy generation, apart from saying that it is prudent to maintain as wide an energy portfolio as possible. But it did recommend that it would be unwise to close the nuclear option and said,

“We argue that the current capacity of nuclear power should be retained.”

Finding the right selection of financial carrots and sticks to reduce carbon emissions and to encourage the use of better and cleaner fuels is not a straightforward matter but the Committee said they shared the criticisms they had received of the Government’s Climate Change Levy, which is anything but a tax on carbon. It is in fact an energy tax, the rate does not vary directly with the carbon content of the fuel and it offers generators no incentives to switch between low and high carbon fuels. The Committee therefore urged “a thorough review of the Climate Change Levy regime with the aim of moving as fast as possible to replacing it by a carbon tax”.

On an international scale the Committee considered that the compliance mechanisms in the Kyoto protocol were weak and even counter-productive. Several witnesses said they would make little difference to rates of warming. Excessive reliance on the “targets and penalties” approach embodied in Kyoto is unlikely to work. The Committee considered that a better approach would be to focus on technology and on more appropriate research and its diffusion.

They reported an interesting comparison which has been made with the 1963-1972 US Apollo programme to put a man on the moon. This cost about 2.5% of US GNP in 1970 or 1% of the then global annual GNP. The International Energy Agency has estimated that a similar expenditure (1% of world GNP) would finance the research and diffusion needed to make carbon-free energy economically viable. This would be a global good in which everyone would share the benefits .

This report reminds us of the relevance of economics in dealing with climate change and raises questions about the Government’s present financial support for reducing CO₂ emissions. The Committee calls on the Government to give the Treasury a more extensive role in examining the costs and benefits of climate change policy and in the work of the IPCC. If climate change is now an important political matter this report will be useful advice in planning a successful policy.

¹ Sir David King, Climate change science: Adapt, mitigate or ignore? Science. 303.176-7, 2004

² Lord Tombs, House of Lords debate, 23 June 2005 Hansard HoL 1787

³ The Economics of Climate Change, House of Lords Select Committee on Economic Affairs, July 2005, HL paper 12-1



House of Commons Select Committee on Science and Technology

Under the Standing Orders, the Committee's terms of reference are to examine "the expenditure, policy and administration of the Office of Science and Technology and its associated public bodies".

The new Committee was nominated on 19 July 2005. Members of the Committee are Adam Afriyie (Con, Windsor), Mr Jim Devine (Livingston), Mr Robert Flello (Lab, Stoke on Trent South), Dr Evan Harris (Lib Dem, Oxford West and Abingdon), Dr Brian Iddon (Lab, Bolton South East), Margaret Moran (Lab, Luton South), Mr Brooks Newmark (Con, Braintree), Anne Snelgrove (Lab/Co op, South Swindon), Bob Spink (Con, Castle Point), Dr Desmond Turner (Lab, Brighton Kemptown), and Mr Phil Willis (Lib Dem, Harrogate and Knaresborough). Mr Phil Willis was elected Chairman of the Committee at its first meeting on 20 July 2005.

Oral Evidence

The corrected transcripts of these evidence sessions are available on the Committee's website.

The Creation of OSI

On 24 April 2006 the Committee took evidence from Rt Hon Alan Johnson MP, Secretary of State for Trade and Industry, Sir Brian Bender, Permanent Secretary at the DTI, Professor Sir Keith O'Nions, Director-General of Science and Innovation, and Professor Sir David King, Government Chief Scientific Adviser and Head of the Office of Science and Innovation. The session focused on the creation of the Office of Science and Innovation from a merger of the Innovation Group and the Office of Science and Technology. The Committee also took evidence regarding the changes proposed in the *Science and Innovation Investment Framework 2004-2014: Next Steps*.

Current Inquiries

Scientific Advice, Risk and Evidence: How Government Handles Them

On 9 November 2005, the Committee announced an inquiry into scientific advice, risk and evidence. The inquiry is focusing upon the mechanisms in place for the use of scientific advice (including the social sciences) and the way in which the guidelines governing the use of such advice is being applied in practice across Government. The Committee has taken evidence from representatives from the Food Standards Agency, learned societies, lobby groups, the Head of the Government Economic Service and a selection of Departmental Chief Scientific Advisers.

During the course of the inquiry, the Committee is also considering a number of case studies including the technologies supporting the Government's proposals for identity cards, the classification of illegal drugs, and the use of MRI equipment and the EU Physical Agents (Electromagnetic Fields) Directive. On identity card technology, the Committee has taken evidence from industrial and academic experts in biometrics and ITC. For the case

study on illegal drugs, the Committee took evidence from scientific experts, lobby groups and the police. In relation to the use of MRI equipment, the Committee took evidence from academics, MR professionals, the Health and Safety Executive, representatives from the Health Protection Agency and the Parliamentary Under-Secretary of State for Work and Pensions, Lord Hunt of Kings Heath. Evidence sessions will continue until June and the Committee expects to report on the case studies in the summer and on the overarching inquiry in the autumn.

Research Council Support for Knowledge Transfer

The Committee announced its terms of reference on 1 December 2005. The inquiry is concentrating upon the effectiveness of the Research Councils' knowledge transfer activities. Terms of reference include the promotion of collaborative working between researchers and partners in industry, stakeholder engagement, results and performance management, and co-ordination between the Councils and the role of RCUK.

The Committee held oral evidence sessions with representatives from the Research Councils, members of the Research Councils' External Challenge Panel, academics and industrialists. The Report is expected shortly.

Human Enhancement Technologies in Sport

On 1 March, the Committee announced a new inquiry focused on the use of human enhancement technologies (HETs) in sport, with particular reference to technologies which are likely to impact on the 2012 Olympics. The Committee is particularly interested in the opportunities and problems presented by the increasing availability of technologies capable of enhancing sporting performance.

The terms of reference include the potential for different HETs to be used legally or otherwise for enhancing sporting performance, the scientific and ethical dimensions of allowing the use of different HETs in sport, the role of the public, Government

and Parliament in influencing the regulatory framework for the use of HETs in sport and the state of the UK research and skills base underpinning the development of new HETs. Oral evidence sessions will begin in early June and continue in the autumn.

Research Council Institutes

The Committee announced its terms of reference on 22 March. The inquiry will focus on the Research Councils' strategies for providing support to their institutes and centres. The terms of reference include the role of institutes in maintaining the UK research and skills base, the balance between Research Council expenditure on institutes and grant funding, the different approaches adopted by the Research Councils on supporting the institutes and a review of progress on current reorganisations of institutes such as the Centre for Ecology and Hydrology. Oral evidence sessions began in late June and will continue in the autumn.

Reports

Chemistry Provision at Sussex University

The Committee published its Second Report of Session 2005–06, *Strategic Science Provision in English Universities: A Follow-up* (HC 1011) on 4 May 2006.

The Report considered the proposed changes to Chemistry provision at the University of Sussex and the role of HEFCE in protecting strategically important and vulnerable subjects. The Committee concluded that there was a fundamental disconnect between the Government's desire to preserve core undergraduate subjects such as Science, Technology, Engineering and Mathematics (STEM) and its desire to preserve the autonomy of universities.

Furthermore, the Report drew attention to the weakness of existing safeguards to protect STEM subjects and the lack of an effective lever to control

strategic science policy. As a result, the Committee recommended that it should be mandatory for universities to alert HEFCE to proposed departmental closures in STEM subjects not less than 18 months before the changes in provision are due to come into effect.

Government Responses

Third Special Report

The Committee published its Third Special Report of Session 2005–06, *Government Response to the Committee's First Report, Session 2005–06: Meeting UK Energy and Climate Needs: The Role of Carbon Capture and Storage* (HC 1036) on 27 April 2006.

Further Information

Further information about the work of the Committee or its current inquiries can be obtained from the Clerk of the Committee, Chris Shaw, the Second Clerk, Celia Blacklock, or from the Committee Assistant, Ana Ferreira on 020 7219 2792/0859/2794; or by writing to: The Clerk of the Committee, Science and Technology Committee, House of Commons, 7 Millbank, London SW1P 3JA. Inquiries can also be emailed to scitechcom@parliament.uk. Anyone wishing to be included on the Committee's mailing list should contact the staff of the Committee.

Anyone wishing to submit evidence to the Committee is strongly recommended to obtain a copy of the guidance note first. Guidance on the submission of evidence can be found at <http://www.parliament.uk/commons/selcom/witguide.htm>.

The Committee has a new website address: www.parliament.uk/s&tcom. All recent publications (from May 1997 onwards), terms of reference for all inquiries and press notices are available at this address.



House of Lords Science and Technology Select Committee

The members of the Committee (appointed 6 June 2005) are Lord Broers (Chairman), Baroness Finlay of Llandaff, Lord Howie of Troon, Lord Mitchell, Lord Patel, Lord Paul, Baroness Perry of Southwark, Baroness Platt of Writtle, the Earl of Selborne, Baroness Sharp of Guildford, Lord Sutherland of Houndwood, Lord Taverne, Lord Winston and Lord Young of Graffham.

Science Teaching in Schools

The Select Committee published in May a call for evidence for a short inquiry on Science Teaching in Schools. This inquiry follows on from previous inquiries in this area including the *Science in Schools* report published in 2001. It will investigate reasons for the decline in the number of A-level entries in the

sciences by addressing, in particular, how teachers and teaching methods can contribute to reversing this decline.

The Committee invited evidence on current statistics on the recruitment, supply and retention of science teachers, how more appropriately qualified science graduates might be attracted to the teaching profession as well as the adequacy of professional

support for existing teachers. It will also look at issues surrounding the role of the practical in teaching science, including the conditions of school labs.

The Committee will be taking oral evidence in June and July and the report is expected to be published in the autumn. On 14 June, the Committee hosted a seminar with five invited speakers. The Committee visited the York National Science Learning Centre on 23 June, and Ministers Lord Adonis and Jim Knight MP gave evidence on 28 June.

Water Management

Sub-Committee I's report into *Water Management* in England and Wales was published on 6 June (8th Report, HL Paper 191). The report received widespread coverage from the press and broadcast media, with a particular focus on the committee's recommendations on leakage, partial disconnection of water supply for non-payers and metering. In reality the report covers a broad range of areas, making recommendations on the regulatory framework, demand management, water supply and the environment.

The central theme of the report is the need for a more integrated approach to water management, bringing together the full range of stakeholders and ensuring that the economic, environmental and social aspects of sustainability are all sufficiently factored into regulatory decision-making. The report's publication

was marked by a seminar organised by the Foundation for Science and Technology, at which Ofwat, the Environment Agency and Water UK set out their initial responses to the report.

Science and Heritage

Sub-Committee II's inquiry into Science and Heritage is approaching its conclusion, and the report is expected to appear in the autumn. The Committee heard from a wide range of witnesses, representing Government, agencies such as English Heritage, the major museums and galleries, academia, research councils, and non-governmental bodies such as the National Trust and Historic Royal Palaces. There were also visits to Italy, and to a range of locations within the UK (the National Gallery, Blickling Hall in Norfolk, Charles Darwin's family home Down House, and the Conservation Centre at the National Museum of Liverpool).

Further Information

The Reports and Calls for Evidence mentioned above can be found at the Committee's web site www.parliament.uk/hlscience. Further information about the work of the Committee can be obtained from Cathleen Schulte (schultec@parliament.uk) who took over as Committee Specialist in May 2006. The Committee's email address is hlscience@parliament.uk



Parliamentary Office of Science and Technology



Recent POST publications

UK civil space activities

March 2006

POSTnote 262

This POSTnote provides an overview of the UK's civil space activities. It focuses on space exploration and Earth observation, discussing UK participation in international projects in the light of decisions made at a European Space Agency ministerial meeting in December 2005. Preparations for the 2007 Comprehensive Spending Review are under way within government, giving rise to increased debate over the future of UK civil space activities. The note highlights key aspects of this debate such as the future of the UK space industry and the role space plays in drawing young people into science and technology careers.

Pervasive computing

May 2006

POSTnote 263

Pervasive computing is a rapidly developing area of Information and Communications Technology (ICT).

The term refers to the increasing integration of ICT into people's lives and environments, made possible by the growing availability of microprocessors with inbuilt communications facilities. Pervasive computing has many potential applications, from health and home care to environmental monitoring and intelligent transport systems. This briefing provides an overview of pervasive computing and discusses the growing debate over privacy, safety and environmental implications.

Current work

POSTnotes are in preparation on:

Biological Sciences and Health – Pandemic flu, Paediatric clinical trials and Avian flu.

Environment and Energy – Carbon footprint of electricity generation technologies, Climate change adaptation in the UK, Soil degradation, Adaptation to climate change in developing countries and Nuclear power plant siting.

Physical Sciences, IT and Communications – Military uses of space, Data encryption, Analogue-digital switchover and Internet security and e-crime.

Seminars

In June POST and Ofcom hosted the fourth in their joint series of parliamentary seminars – on Emerging uses of broadband internet, with a demonstration of the technology afterwards.

In July POST will collaborate with the British Psychological Society in a parliamentary seminar entitled Sustainability: Making Britain Green.

Fellows and interns at POST

Jane Strachan (Reading University) joined POST in June as a NERC Fellow to work on a POSTnote on Adaptation to climate change in developing countries.

David Wills (Nottingham University) also joined POST in June as an ESRC Fellow to work on a POSTnote on Internet security and e-crime.

International activities

In May POST hosted the biennial European Parliamentary Technology Assessment network practitioners' meeting at Wye College, Kent. This brings together many of the non-directorial staff of the network. Discussion at the meeting covered three main themes – how to measure impacts of activities, managing international projects and the use of new methods for technology assessment. Over 35 delegates attended from nine EPTA organisations: the Danish and Norwegian Boards of Technology, viWTA (Flanders), the Rathenau Institute (Netherlands), TA-Swiss, ITA (Austria), TAB (Germany) and STOA at the European Parliament, along with the non-directorial staff of POST.

Also in May POST hosted a special seminar in the House of Lords on stem cell research for an inbound mission from the US Congress, including three Congresspeople, and staff of Senators and Senate committees. The mission held discussions with the Bishop of Oxford and Baroness McIntosh, chair and member of the 2002 House of Lords *ad hoc* committee on stem cells and Dr Evan Harris MP, POST Board member.

Parliamentary and Scientific Committee and Other News

Parliamentary and Scientific Committee

Election of Office-Holders

The following office-holders were elected at the Committee's Annual General Meeting on Monday 22nd May:

Hon Treasurer: Dr Ian Gibson MP

Vice-Presidents: Dr Brian Iddon MP
Dr David Dent

Advisory Panel: Professor Alan Malcolm

New Members

We are delighted to welcome the following new members:

The Viscount Montgomery of Alamein CMG CBE

The Biosciences Federation – Dr Emma Southern

Abbott Diagnostics – Mr Andy Bufton

Amgen Limited – Ms Jenny Snell

Chelsea Technologies Group – Mr Richard Burt

Eli Lilly – Dr Paul Johnson

Mylnefield Research Services – Dr Nigel W Kerby

Trident Sensors Ltd – Dr W R Simpson

PITCOM's Twenty-fifth Anniversary

We offer our good wishes to the Parliamentary Information Technology Committee (PITCOM), which celebrated its 25th Anniversary with a reception on the House of Lords Terrace on 26th June. Sir Ian Lloyd MP launched PITCOM on 21st January 1981, after he and John McWilliam MP recognised that "IT was not a party, but a national concern, and that there must be very few areas of policy that are not influenced by, if not significantly dependent upon, IT". They have been proven to be right, from the heated debates on liberalising telecoms of 1982-84, through Tony Blair's pushing the e-government agenda since 1997, to this year's ID card Bill. PITCOM has been there to help MPs and Peers through these confusing times.

PITCOM was shaped on the same model as the Parliamentary & Scientific Committee, and retains much the same constitution today, under the Chairmanship of Andrew Miller MP, despite the many vicissitudes that have befallen All-Party groups in the intervening 25 years. It has recorded these years in a short history, available from membership@pitcom.org.uk, which could be of interest to anyone who would like to track the ups and downs of IT in the UK, but also to those who would like to see how a technical All Party Group can remain a focus for Parliamentarians after 25 years



Archives for Africa

The Secretary of State for International Development launched a pioneering new initiative entitled Archives for Africa at the House of Commons on Tuesday 28 February co-hosted by Dr Brian Iddon MP and Mr Mark Lancaster MP. The Royal Society of Chemistry's digital archive – which contains every scientific paper

published in RSC journals for over 160 years (dating back to the Society's foundation in 1841) – is being made available free of charge to African countries.

Two African scientists were present at the launch and each explained how the Archive could help their work. Robert Mokaya spoke about his early work in Kenya while Hareg Tadesse, a PhD student from Addis Ababa University, Ethiopia, currently at the University of Nottingham for one year of her research said "It was really hard in Addis for me to get hold of the right papers. This is where the Archive is going to be so useful. Now students like me in Addis can get the RSC Archive straight away, when we need them."

PERI (the Programme for the Enhancement of Research Information) is helping to host the Archive, which is also available to a number of developing countries outside Africa. For a nominal fee the latest three years of the RSC's scientific journals can also be bought. The UK Permanent Delegation to UNESCO and the UK National Commission for UNESCO also supported the initiative.



Debates and Selected Parliamentary Questions & Answers



Following is a selection of Debates and Questions and Answers from the House of Commons and House of Lords.

A full digest of all Debates, Questions and Answers on topics of scientific interest from 18th April to 25th May 2006 from both Houses of Parliament appears on pages 47 to 51

Education

Education: Science and Technology

Debate in House of Lords on Thursday 20 April

Baroness Greenfield rose to ask what account the Government are taking of the impact of fast-moving advances in science and technology on how young people think and learn in planning future education policy. Science is now delivering a diverse range of information technology, nanotechnology, and biotechnology with a speed that we could never have predicted even a decade ago. This was followed by a long discussion on the opportunities and benefits to be gained from access to electronic multimedia, such as the internet, provided training is available in interpretation and use of the data thus obtained.

Lord Stone of Blackheath emphasised the importance of education and scientific information to enable people to strike an appropriate balance between risk and safety and achievement and opportunity. That is where science can help everyone, future scientists and non-scientists alike.

Baroness Warnock suggested that the new flexible classroom should be able to open up to the non-scientific world the imaginative possibilities of the scientific world since people could be introduced to the concepts of science and learn to be critical through the internet and the interchange and organisation of information.

Baroness Morris of Yardley came across a good little book *Less is More*, by Human Scale Education which described the national curriculum in 1904 and 1989 which is still with us. We can see that the subjects we teach, what we call them, how we arrange them in the school day and even the amount of time we allocate to each discipline area has barely changed in almost a century. That is the great problem with teaching, learning and schools.

Lord St John of Bletso pointed out that the most recent research from the Office of Science and Technology indicated that while 86 per cent of the population believe that science makes a good contribution to society and that technology improves their lives, only 17 per cent of that study believed that

consultation on science and technology issues with Government had an impact on policy as the Government are unlikely to listen to them.

Lord Dearing regretted the withdrawal in the budget of the home computing initiative which enabled those who are not highly paid to forego part of their income to purchase a computer through their employer, aided by tax exemptions.

Baroness Walmsley drew attention to research that had suffered death by tabloid headline, namely the Tomlinson report on education for 14 to 19 year-olds, which proposed far reaching reforms. Mike Tomlinson had proposed a gradual incorporation of the best aspects of A-levels into something more fit for purpose in our modern society.

Baroness Buscombe quoted James Dyson on how young people were being groomed for university to become middle-class professionals, avoiding industry and manufacturing, unlike in France and Germany where engineering is held in high esteem and most pupils continue with some science right through school.

The Parliamentary Under-Secretary of State, Department for Education and Skills (Lord Adonis): thanked Baroness Greenfield for initiating the debate which had touched on many of the issues discussed in her book, *Tomorrow's People*, about the impact on our society of the pace of technological and scientific progress. The Building Schools for the Future programme is replacing or renewing the entire secondary school estate over a 15-year period. State-of-the-art science facilities are a part of that. Since 1997 there has been a 30 per cent increase in the number of new science teachers. The teacher training bursary rose to £7000 in September 2005 and will rise to £9000 this September. The "golden hello" for new science teachers rose to £5000 for trainees entering PGCE and equivalent courses in September last year, and we are also recruiting a new cadre of specialist, science higher level teaching assistants to enable every secondary school to recruit at least one by 2007-08, alongside the development of the new national and regional science learning centres set up as a long-term investment in science education as part of an important £51 million partnership with the Wellcome Trust. One element of a £32 million package of measures made by the Chancellor over the next two years to improve science teaching and learning includes a boost to the availability of three individual sciences at GCSE, including physics, for students scoring highly at key stage 3 tests at age 14, resulting in increased student uptake of A-level science with higher grades achieved leading to science degrees at university.

Universities: Research and Development

Debate in House of Lords on Thursday 27 April

Lord Patten of Barnes rose to call attention to the role of British and other European universities in the promotion of research and development. He had attended the European Council meeting in Lisbon six years previously as a European Commissioner which had produced the strategy for turning Europe into the most dynamic and competitive economy in the world by 2010. It would be wrong to argue that nothing had been achieved, although it is inexplicable that so little investment has been made in R&D and higher education because universities remain the most important research incubators in our society. In Europe the problem is that not enough is spent on the universities. The EU average spend on higher education is 1.1 per cent of GDP whereas the US spends 2.6 per cent. Hence US taxpayers spend more on higher education as a proportion of GDP than those in France and Germany and considerably more than taxpayers in this country. The OECD points out that most European countries "are holding back their universities by neither making the required public investment nor allowing universities to charge tuition fees". You have to do one or the other or preferably both, because the alternative is that UK universities will continue to fall further behind those in the US, and will be overtaken by India and China. A decade ago, half the young Europeans who went to the US to do PhDs returned to Europe. The latest figures show that only a quarter returned to Europe. We urgently need to establish a European patent, ensure that the European Research Council is properly funded, forget about the half-baked idea of establishing a European institute of technology, and shift resources from the CAP and structural funds and concentrate them on competition, R&D, economic growth, and the creation of jobs.

Lord Giddens rejected the notion that expansion of research will be driven mostly by companies who generally wish to reduce the amount they spend by outsourcing research to China and elsewhere. The only way to motivate research expenditure by companies in the EU or UK is through taxation incentives.

Lord Wallace of Saltaire doubted the rationale for the proposed European institute of technology and recommended a virtual network in preference to a physical site.

Lord Rees of Ludlow agreed that there are few world-class universities on mainland Europe since the best research is mostly undertaken outwith the university system by Max-Planck institutes in Germany and by CNRS in France. The UK does belong to consortia such as CERN in Geneva which have been immensely

successful. The European Southern Observatory has the world's best telescopes. The European Space Agency could gain ascendancy if it focused on science, miniaturisation and robotics, leaving NASA to squander its far larger budget on ill-conceived grand projects for manned space flight. The European Research Council should help strengthen the leading European universities.

Lord Parekh complained that when universities are financially squeezed there has been pressure to squeeze out philosophy, theology, art, literature and classical languages. That is not the way to proceed, since universities should be judged not just by their contribution to research and economic development but by their contribution to the understanding of human civilisation, and be given credit for that.

Lord Norton of Louth emphasised the role of teaching and that research and teaching are complementary pursuits which enhance the student experience and contribute to the nation's wealth creation.

Baroness Thomas of Walliswood was concerned at the number of projects given the Lisbon agenda seal of approval simply because they have something to do with learning or knowledge, although the agenda does not confer automatic acceptability on any and every proposal presented under that seal of approval. It is important to be just as discriminating about those proposals as any other.

Lord Patel acknowledged wide support for a fresh approach to the RAE. The argument is reasonable that metrics-based allocation should constitute the main methodology for funding council dual support for the more mature science/engineering/medicine area. That may not be the case in the arts and humanities where a form of peer-based review might be more appropriate.

Lord Haskel proposed that it does not matter where research is done at universities as long as the UK benefits from it, as this is an important aspect of globalisation.

Lord Broers indicated that the RAE with its heavy emphasis on publications has done a poor job on assessing technological research and may well have had a detrimental effect on output by driving investigators inappropriately to use the methods used in pure science to disseminate their results. The UK is now less competitive in university research in applied research and technology than in pure science subjects, and a diversity of assessment methods should be explored. The UK will forget at its peril that its major competitor has no such exercise.

Baroness Warwick of Undercliffe indicated that the Chancellor, who does not have a track record of bringing simplicity to any process or structure that he

has reviewed in the 10 years he has been in office, has announced proposals for changes to the research councils which will be "radically simplified".

Lord Winston presented a case study using cells which would otherwise be thrown away, in which delays in approval procedures by the Home Office, and the HFEA, consumed the entire time allocated and all of the £3 million investment for the research, resulting in low morale, loss of staff, and which poses very serious issues in regard to medical schools.

Baroness Sharp of Guildford pointed out that the purpose of R&D is not only to generate new ideas and knowledge but crucially to train people in leading-edge scientific and technological techniques to provide an entry ticket into international networks which enables access to the international science base.

Lord McKenzie of Luton pointed out that this was the third occasion on which research and development had been debated in the past few weeks and in this debate UK research was considered in its international context. A comprehensive overview of the Government's position was presented. Reference was also made to many of the issues raised in the debate accompanied by offers of further consultation concerning the Government's many and varied financial and structural initiatives, and finished with the Chancellor's intention to make "Britain one of the most competitive locations for science, research and development, and for innovation".

Science (UK Universities)

Debate in Westminster Hall on Wednesday 3 May

Dr Vincent Cable (Twickenham) introduced the debate on this important subject and touched on four interconnected issues, the overall funding position, the availability of students to do science in universities, the formula that is used for allocating funding for science teaching, and the basis of allocation of science research in universities. It is ironic that the private sector, which used to be regarded as the preserve of effete generalists, is increasingly one of the few sectors of education where people do double maths, which is a necessary foundation for advanced physics. That is worrying because people in the maintained sector who have limited means are simply not getting access to teaching in those important disciplines.

However, the main interest in this debate relates to the discussion around the recent spate of science laboratory closures in major universities due to funding formula problems and the Minister's response, both of which are presented in some detail.

One of the most damaging decisions to have been made in recent years was that by the Higher Education

Funding Council when funding for science teaching, which used to be at the level of 2.1 per cent of the baseline, was arbitrarily cut to 1.7 per cent. Putting it crudely, the non-science faculties seem to have ganged up on the scientists and switched a large amount of funding out of university science departments, which effectively had received a cut of 20 per cent. A circular and damaging argument was used. It had been noted that science faculties were doing much less laboratory work and concluded therefore that less money was needed. However, less laboratory work was being done because the funding was inadequate. That decision was very damaging. Is that a matter on which the Government have any say as after all the Government are the main funding body for universities? The decision seems to have been taken by a Government quango and the feedback received is that if that decision could be reversed, it would do more than anything to improve the position of science departments in universities.

The Minister for Higher Education and Lifelong Learning (Bill Rammell) responded with a well rehearsed account of the Government's funding arrangements. The Government also wants to provide pupils with more opportunities to study three separate sciences at GCSE. If laboratory-based science is relatively underfunded something else must be relatively overfunded. It is not enough just to argue that it would be helpful for science to receive more funding in the formula. Anyone with credibility who proposes changes to the formula also has to find sustainable and convincing evidence that other subjects are relatively overfunded.

Energy

Geothermal Energy

Question and Written Answer on Tuesday 18 April

Mr Chope (Christchurch): To ask the Secretary of State for Trade and Industry what the policy of the Government is on the production of energy from geothermal sources.

Malcolm Wicks: Between 1976 and the early 1990's the UK carried out a major Geothermal Research Programme at a cost in excess of £50 million. The key conclusions from the programme were that the UK is unlikely to see major developments based upon geothermal aquifers or the hot dry rock (HDR) method due to a limited resource, poor economics and limited scope for their application.

Unless the technical, practical and economic constraints identified under the previous Geothermal Programme can be addressed, the prospects for geothermal power in the UK would appear to be limited.

More recently interest has been growing in the use of Ground Source Heat Pumps. This technology can be applied to buildings of virtually any scale including domestic dwellings. It relies on heat exchange with the ground immediately beneath or close to buildings. There are at least 15 installations connected to commercial or public buildings in the UK, including the recently opened Welsh Assembly building.

Both Defra and the DTI, in collaboration with the Heat Pump Association, have helped establish a UK Heat Pump Network to develop a partnership between manufacturers, specialist advisers, and user groups. This network will ensure that independent and authoritative advice is available on the application and use of heat pumps.

Energy Efficiency (S&T Report)

Debate in House of Lords on Thursday 27 April

Baroness Perry of Southwark rose to move, That this House takes note of the report of the Science and Technology Committee on Energy Efficiency (2nd Report, HL Paper 21). Energy efficiency is everyone's business, not just that of scientists and engineers. People are consumers of energy and contributors to the carbon emissions that threaten the planet. The 2003 Energy White Paper sets out a strategy for reducing these emissions and for meeting these targets that are unlikely to be met. This report is the committee's second detailed examination of the major themes of the Energy White Paper, following on from the 2004 enquiry chaired by Lord Oxburgh into the practicalities of renewable energy. The Government's responses to both reports have been extremely disappointing as indicated in the committee's annual report, "the response to a large extent simply described at length existing policies, initiatives and instruments, without appearing to grasp the strategic vision underlying our Report". It is to be hoped that the current Energy Review, chaired by the Minister, Malcolm Wicks, will provide an opportunity for this fundamental rethink. If not, the Government's policies on energy will be doomed to failure.

Baroness Sharp of Guildford indicated that the report is comprehensive in all but one sense – it does not cover transport which would have opened up a huge new area to look at and where remarkably little has been done to try to limit growth. The big increase in transport has been in aviation and it remains a scandal that aviation fuel is untaxed. The report refers to measures that are necessary to promote energy efficiency and concentrates particularly on the domestic sector, which, after transport, is the highest cause of carbon emissions in the UK. Even after the latest review building regulations will not match the best standards in Europe. Furthermore there are many

difficulties in enforcing those regulations with several examples given. Leadership is needed from central government and should involve local authorities who have been able to develop community spirit.

Lord Patel made the case for much greater use of low-grade heat in combined heat and power as demonstrated to be working well in Denmark and Sweden and thus making more efficient use of the available energy.

Lord Lewis of Newnham emphasised the need for energy saving procedures for incorporation in house design in the light of the Government's proposal to build one million new houses by 2010. In addition, a wide range of heat efficiency improvements were presented in house design and benefits that could be obtained from local heating schemes.

Lord Broers explained the need for smart meters that would enable householders to realise the importance of energy conservation while also enabling modern power electronics equipment to interface carbon-free micro-generators of electricity with the supply grid.

The Parliamentary Under-Secretary of State, Department for Environment, Food and Rural Affairs (Lord Bach) responded to the previous speakers by indicating that considerable progress had been made since the committee published its report through this year's budget and in the UK climate change programme. New provisions in building regulations came into force which, together with the previous revision in 2002, give a 40 per cent improvement in the energy performance of new buildings. A review of measures to tackle existing buildings is also under way with recommendations to Ministers this summer. Robust provisions on smart metering and related technologies is also under way, including the launch of the first interactive smart metering trial in the residential sector. This trial managed jointly by EDF Energy and National Energy Action will see 3000 electricity and smart gas meters installed in homes over the next two years. A new support scheme for heat generation from renewable resources in the industrial, commercial and community sectors will run for five years. An action plan for renewable energy in biomass was recently announced. With regard to criticism of the present ministerial responsibilities for energy-related and climate change issues that are spread across several departments, the question is what alternatives do the opposing Front Benches have to offer?

Fuel Cell Technology

Question and Written Answer on Wednesday 10 May

Mr Drew (Stroud): To ask the Secretary of State for Trade and Industry what help his Department makes available to companies researching hydrogen fuel cell

technology for motor vehicle use through a greater understanding of nuclear energy.

Malcolm Wicks: The DTI commissioned two reports in 2004 in relation to hydrogen: "Hydrogen Energy Support in the UK" and "A Strategic Framework for Hydrogen Energy Activity in the UK". These reports have been published on the Department's website. The second report identified six potential hydrogen energy chains for the use of hydrogen as a transport fuel. One route is to produce hydrogen from nuclear generation.

On 15 June 2005, I announced the Government's response to the second report "A Strategic Framework for Hydrogen Energy Activity in the UK" which included a funding package of £15 million over four years for a UK wide hydrogen and fuel cell demonstration programme. The details of the demonstration scheme is currently being developed, and requires EC state aid approval.

Home Affairs

Forensic Science

Debate in Westminster Hall on Thursday 20 April

Mr Phil Willis (Harrogate and Knaresborough): The Government's decision to develop the Forensic Science Service (FSS) into a Government-owned company, or a GovCo, with a possible progression to a public-private partnership (PPP) thereafter, has been a source of great controversy. The GovCo must not be set up to fail but must be given the chance to succeed in its own right and must not be just a transition step to a PPP. It cannot be right for the Government to set the criteria by which the FSS GovCo will be assessed, then, as the sole shareholder, assess whether those criteria have been met and then to influence the management of the FSS during the transition to PPP status, which should not be the inevitable outcome. Competitor providers such as the Forensic Alliance and LGC are frustrated at what they see as the lack of a level playing field as regards competition for forensic science services, particularly where police forces are involved. The Government must do their utmost to ensure that the FSS remains an attractive employer, because it is far too important a national asset to be allowed to fall into a state of decay. Amanda Burton and "Silent Witness" have created a huge amount of interest in forensic science with the result that from September it will be possible to choose from 445 degree courses with forensic in their title. For example, Canterbury Christ Church University are able to offer a degree in forensic investigation combined with tourism and leisure studies, or music combined with forensic investigation. The massive expansion in forensic science courses has taken place largely without quality control. Whereas it may be advantageous to have a general understanding

of forensic science as a police officer, forensic science as a profession relies on scientists with expertise in primary scientific subjects such as chemistry and physics.

Dr Ian Gibson (Norwich, North): Forensic science involves many different individuals and agencies in research and development and in promoting understanding of the role of forensic science in the criminal justice system. It is an ever expanding area and the Select Committee report has made a dent in the situation and illustrates the problems that are being spoken of in professional societies and the Science and Technology Select Committee should be congratulated on its work in bringing this important topic to the attention of Government.

Mr Brooks Newmark (Braintree): The Government do not inspire confidence in their ability to make a success of the FSS as a PPP and we should also be sceptical about tinkering with an essential public service, which does much to underpin our criminal justice system. That reason, as much as the first, is one of the primary objections to privatisation of the service.

Dr Brian Iddon (Bolton, South-East): The Government recently published the four sets of criteria that need to be met: 1) The needs of the UK criminal justice system should be met; 2) The Government should seek assurance that a competitive marketplace will develop for forensic science; 3) The FSS needs to improve its accommodation with state-of-the-art facilities; 4) The Government will have to consider the FSS's needs as a shareholder when converting to PPP. If money is lost the FSS will have a problem.

Mr Phillip Hollobone (Kettering): Northamptonshire police's scientific support unit led by Dr John Bond is one of the best in the country but is imperilled by the proposed police mergers. If this all goes wrong it could end up with fewer crimes being detected as a result of forensic science.

The Parliamentary Under-Secretary of State for the Home Department (Andy Burnham): The Home Office through the DNA expansion programme has been investing resources into the use of DNA, and more generally into the quality of science available to police forces. The trading fund status was revoked and the GovCo created in December 2005. No decision will be taken to change status to a PPP before the summer of 2007. Criteria were published on 29 March setting out the four areas by which the GovCo will be judged in due course, though no decision has been taken to give the FSS time to adapt to its new GovCo status and to see what benefits it brings, and how the service can use them to improve its operation. The staff are now public servants rather than civil servants.

There is no intention to build a national DNA database. Only about 30 highly security cleared individuals have direct access to the national DNA database. It cannot be accessed from police stations and there are strict controls on who is able to gain direct access to that information. It is hoped that sharing information on unsolved crimes with European colleagues will help with their solution. A strong argument can be made that larger police forces would use science far more effectively and invest in it far more strategically.

Animal Experimentation

Question and Written Answer on Thursday 25 May

Lyn Brown (West Ham): To ask the Secretary of State for the Home Department what steps his Department is taking to encourage the development and validation of alternative methods of scientific experimentation to replace and reduce the use of animal experiments.

Joan Ryan: The Home Office is fully committed to encouraging the development of alternatives to animal experimentation where this is possible. Indeed, under the Animals (Scientific Procedures) Act 1986, we will not license the use of animals in scientific procedures if alternative non-animal techniques are available.

In addition, the Home Office contributes £250,000 annually to the National Centre for the Replacement, Reduction and Refinement of Animals in Research (NC3Rs) which was established by the Government in May 2004 to co-ordinate and stimulate research and practice in the 3Rs. The NC3Rs funds high-quality 3Rs research and facilitates the exchange of information and ideas, the identification of knowledge gaps, and the translation of research findings into practice to benefit both animals and science. The Centre submits an annual report to the Minister for Science and Innovation on its activities, the first of which was published in January 2006 and is available on their website at: www.nc3rs.org.

Internationally, the United Kingdom Government continues to support the European Centre for the Validation of Alternative Methods (ECVAM) through contributions to the European Union. We take a lead in formulating European policies, standards and targets which neither disadvantage the United Kingdom nor drive work abroad to countries where lower standards apply.

Science Policy

Nano Materials

Question and Oral Answer on Wednesday 24 May

Baroness Miller of Chilthorne Domer asked Her Majesty's Government whether, after their current consultation, they plan to develop a regulatory

framework that covers specifically the production or application of nano materials.

The Minister of State, Department for Environment, Food and Rural Affairs (Lord Rooker): My Lords, my department is currently gathering evidence to support decisions on the best ways to control any risks from the production and use of nano materials. This involves government-led research, supported by a proposed voluntary scheme. The evidence will be reviewed in two years, and, if sufficient information is available, we will make proposals for appropriate control.

Baroness Miller of Chilthorne Domer: My Lords, I thank the Minister for his reply. Does he accept that this is a fast moving area of technology with very exciting developments and that the UK has not led the field, as recognised in the report from the other place entitled *Too little too late*? We are losing out on some of the benefits of this exciting technology. Given the timescale involved, is the Minister confident that some

of the hazards that this country will face – the products are already being imported and used here – will not pose a threat to human health or the environment? We just do not know whether they will. The resources devoted are too little, and the time taken by his department is too long. The market will be flooded with these products before we know much about them.

Lord Rooker: My Lords, it is not as if it has happened overnight. The voluntary scheme that I referred to should start in late summer this year, and the public consultation that was initiated in March will finish on 23 July. The process was initiated by my noble friend Lord Sainsbury in June 2003 when the Royal Society and the Royal Academy of Engineering were asked to investigate the implications. I realise that this is important technology and that products are now in use. I am told that probably dozens of laboratories and private companies are exploring and using these very tiny materials around the country.

Progress of Legislation before Parliament

A comprehensive list of Public Bills before Parliament, giving up-to-date information on their progress through Parliament, is published regularly when Parliament is

sitting in the Weekly Information Bulletin, which can be found at:

<http://www.publications.parliament.uk/pa/cm/cmweb.htm>

UK Parliament - Digest of Parliamentary Debates, Questions and Answers

18th April – 25th May 2006

The references are to Hansard, giving first the date of publication, either HoC (House of Commons) or HoL (House of Lords), and finally the column number in Hansard.

**Denotes selected Debates and Questions and Answers of particular interest which are reproduced on pages 41 to 47*

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Nitrates Directive – 18.5.06 HoC 1203W
Water: Agriculture – 15.5.06 HoL WA14

Animal Experiments

* Animal Experimentation – 25.5.06 HoC 2015W
Procedures – 4.5.06 HoC 1827W
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Medical Research (Animals) – 23.5.06 HoC 446WH
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Biological and Chemical Weapons

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Weapons of Mass Destruction – 22.5.06 HoC 1334W

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Badger Casualties (Bovine TB) – 16.5.06 HoC 835W
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* Forensic Science – adjournment debate – 20.4.06 HoC 139WH
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Defence Industrial Strategy – 22.5.06 HoC 1196
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* Education: Science and Technology – debate – 20.4.06 HoL 1219
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* Science (UK Universities) – adjournment debate – 3.5.06 HoC 468WH
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* Universities: Research and Development – debate – 27.4.06 HoL 275
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Energy

- Alternative Energy – 2.5.06 HoC 1363W
- Biofuels – 11.5.06 HoC 499 & 24.5.06 HoC 1817W
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 - Biofuels – 23.5.06 HoL WA94
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- Renewable – 15.5.06 HoL 9
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- * Fuel Cell Technology – 10.5.06 HoC 262W
- Gas Supply Infrastructure – 16.5.06 HoC 49WS & HoL WS8
- * Geothermal Energy – 18.4.06 HoC 607W & 26.4.06 HoC 1124W
- Low Carbon Buildings Programme – 18.4.06 HoC 608W
- Microgeneration – 3.5.06 HoC 956
- Nuclear Energy – 2.5.06 HoC 1376W
 - Fusion Plants – 4.5.06 HoC 1740W
 - Power – 23.5.06 HoC 1635W
- Photovoltaic Industry – 19.4.06 HoC 676W & 26.4.06 HoC 1128W
- Renewable Energy – 26.4.06 HoC 553, 2.5.06 HoC 1379W, 10.5.06 HoC 265W, 22.5.06 HoC 1459W & 24.5.06 HoC 1824W
- Severn Estuary Barrage – 3.5.06 HoC 957, 10.5.06 HoC 266W & 22.5.06 HoC 1460W
- Solar Photovoltaics – 18.4.06 HoC 619W
- Tallow – 15.5.06 HoL WA13 & 18.5.06 HoC 1205W
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Environment (Pollution)

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- Emissions – 25.4.06 HoC 975W
- Nitrogen Dioxide Emissions – 16.5.06 HoC 845W
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- Waste Management – 2.5.06 HoL WA62

Environment (Protection)

- Environmental Liability Directive – 23.5.06 HoC 1690W
- Forest Service Agency – 10.5.06 HoC 28WS & HoL WS56
- Forestry – 27.4.06 HoC 1235W
- Invasive Top Mouth Gudgeon – 18.4.06 HoC 29W
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- Marine Environment – 24.5.06 HoC 88WS
- Oak Trees – 22.5.06 HoC 1307W
- Ring Rot – 25.4.06 HoC 984W
- Sonar (Marine Mammals) – 18.4.06 HoC 12W
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EU Meetings

- Agriculture and Fisheries Council – 25.4.06 HoC 36WS & 9.5.06 HoC 9WS
- Competitiveness Council – 26.4.06 HoL WS15, 25.5.06 HoC 99WS & HoL WS60
- Environment Council, Brussels – 19.4.06 HoC 10WS
- EU Education Council – 17.5.06 HoC 58WS & HoL WS21
- EU: Education Ministers Meeting – 15.5.06 HoL WS1 & HoC 37WS

Fisheries

- Cetaceans – 2.5.06 HoC 1313W, 4.5.06 HoC 1728W & 8.5.06 HoC 10W
- Fisheries – 2.5.06 HoC 1514W & 22.5.06 HoC 1299W
- Fishing: Salmon – 2.5.06 HoL WA53
- Marine Fisheries Agency – 16.5.06 HoC 48WS

Food and Nutrition

- Children: Health – 4.5.06 HoL WA96
- Drinking Water – 3.5.06 HoC 1695W
- Food – 3.5.06 HoL WA75
 - Education – 11.5.06 HoC 470W
 - GM – 24.4.06 HoL WA3 & 25.4.06 HoL WA12
 - Labelling – 18.4.06 HoC 217W
 - Supplements – 4.5.06 HoC 1774W
- Fruit/Vegetable Consumption – 9.5.06 HoC 229W
- Genetically Modified Organisms – 18.4.06 HoC 389W
- GM Crops – 12.5.06 HoC 583W
- Malnutrition – 24.4.06 HoC 960W & 4.5.06 HoC 1777W
- Obesity – 10.5.06 HoC 401W
- Salt – 18.4.06 HoC 261W
- Salt Intake – 24.4.06 HoC 966W & 2.5.06 HoC 1548W
- School Food – 18.4.06 HoC 177W & 17.5.06 HoC 977W
- Trans Fatty Acids – 22.5.06 HoC 1590W
- Transfats – 18.4.06 HoC 269W

Health (Cancer)

- Bowel Cancer – 18.4.06 HoC 190W & HoL WA167, 3.5.06 HoL 459, 8.5.06 HoL WA111, 9.5.06 HoC 134W, 10.5.06 HoC 382W, 11.5.06 HoL WA151 & 16.5.06 HoC 971
 - Screening – 25.4.06 HoC 1070W
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 - Rates – 17.5.06 HoC 1068W
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- Colon Cancer – 10.5.06 HoC 383W
- Colorectal Cancer – 3.5.06 HoC 1692W
- Erythropoietin – 18.4.06 HoC 215W
- Herceptin – 18.4.06 HoC 225W, 9.5.06 HoC 201W, 11.5.06 HoC 555W, 15.5.06 HoC 747W & 16.5.06 HoC 929W
- Lung Cancer – 26.4.06 HoC 1172W & 22.5.06 HoC 1568W
- Malignant Disease – 19.4.06 HoC 738W
- Multiple Myeloma – 3.5.06 HoC 1704W
- Ovarian Cancer – 10.5.06 HoC 403W
- Photodynamic Therapy – 9.5.06 HoC 238W

Prostate Cancer – 24.4.06 HoC 965W & 9.5.06 HoC 135W
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 Biotinidase Deficiency – 2.5.06 HoC 1471W
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 Duchenne Muscular Dystrophy – 11.5.06 HoC 554W
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 Embryonic Stem Cells (Teeth) – 15.5.06 HoC 745W
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 Fluoridation – 3.5.06 HoC 1695W
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 Folic Acid – 3.5.06 HoC 1696W & 4.5.06 HoC 1774W
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 Medical Research – debate – 11.5.06 HoL 1103
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 Myalgic Encephalomyelitis – 18.4.06 HoC 391W, 11.5.06 HoC 556W, 22.5.06 HoC 1569W & 25.5.06 HoC 1932W
 Obesity – 18.5.06 HoC 1176W & 22.5.06 HoC 1580W
 Parkinson's Disease – 4.5.06 HoL 660
 Parkinson's Disease – adjournment debate – 25.4.06 HoC 239WH
 Power Lines (Advisory Group Report) – 22.5.06 HoC 1584W
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Health (Influenza)

Anti-viral Influenza Drugs – 18.4.06 HoC 188W
 Avian Influenza – 18.4.06 HoC 384W, 2.5.06 HoC 1394W & 22.5.06 HoC 1551W
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 Vaccination (Influenza) – 18.4.06 HoC 375W

Health (Information Technology)

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 IT Reviews – 16.5.06 HoC 939W
 National Programme for IT – 16.5.06 HoC 831 & 24.5.06 HoC 1879W
 NHS IT Programme – 16.5.06 HoC 943W, 17.5.06 HoC 1113W & 23.5.06 HoC 1758W

Health (International Development)

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 Global Fund to Fight AIDS, TB and Malaria – 23.5.06 HoC 1614W
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HIV/AIDS – adjournment debate – 11.5.06 HoC 149WH
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 Pharmaceutical Industry – 3.5.06 HoC 1557W
 Poliomyelitis (Nigeria) – 4.5.06 HoC 1793W

Health (Service)

Bone Marrow Donors – 27.4.06 HoC 1296W
 Hepatitis C: Contaminated Blood Products – 19.4.06 HoL 1054
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Health (Vaccines)

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 Identity Card Scheme – adjournment debate – 10.5.06 HoC 131WH
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Industry

Manufacturing: Motor Vehicles – 22.5.06 HoL WA84
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Africa: Climate Change – 16.5.06 HoL WS7 & HoC 48WS
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 Farming (India) – 11.5.06 HoC 461W
 Renewable Energy – 20.4.06 HoC 770W
 Water and Sanitation – 4.5.06 HoC 1795W
 Water Strategies – 15.5.06 HoC 676W

Medicines and Drugs

Adverse Drug Reactions – 2.5.06 HoC 1529W & 15.5.06 HoC 736W
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 Animal Insulin – 19.4.06 HoC 732W
 Anti-depressants – 23.5.06 HoC 1738W
 Biomedicine and Human Rights – 27.4.06 HoL WA39

Cannabis-based Medicine – 15.5.06 HoC 740W
 Clinical Trial: TEN1412 – 25.5.06 HoC 94WS & HoL WS57
 Clinical Trials – 18.4.06 HoC 386W, 19.4.06 HoC 734W & HoL WS141 & 2.5.06 HoC 1533W
 Combined Contraceptive Pill – 22.5.06 HoC 1555W
 Diabetes – 3.5.06 HoC 1694W & 15.5.06 HoC 745W
 Diet-drug Interactions – 26.4.06 HoC 1211W
 Generic Drugs – 18.4.06 HoC 218W
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 Medicine Reviews – 26.4.06 HoC 1214W
 Medicines and Health Products Regulatory Agency – 19.4.06 HoC 13WS & 740W, 4.5.06 HoC 1778W & 11.5.06 HoC 556W
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Science Policy

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 * Nano Materials – 24.5.06 HoL 819
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 Veterinary Laboratories Agency – 16.5.06 HoC 47WS
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 Global Monitoring for Environment and Security – 18.5.06 HoC 1137W & 23.5.06 HoC 1692W

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 Fisheries Agreements – 23.5.06 HoC 1690W
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Telecommunications and Broadcasting

Digital Switchover – 26.4.06 HoC 1132W
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Transport

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 Composting – adjournment debate – 9.5.06 HoC 58WH
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 Recycling – 25.4.06 HoC 978W
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 Incinerators – 18.4.06 HoC 35W

Water

Fluoridation – 18.4.06 HoC 216W
 Water Supply – 17.5.06 HoC 999 & HoL 272

Breast Cancer Research

A manifesto to support breast cancer research and improve standards of patient care has been presented to doctors, nurses, patients and advocacy groups at the European breast cancer conference in Nice, France. Breast cancer is the most common cancer affecting women in Europe. Europe is now 500 million strong, and more than half of these are women, of whom at least 1 in 10 will experience breast cancer (ie > 25 million women). Breast cancer research is under threat due to insufficient funding in many European countries and studies which answer important clinical questions and which have the potential to increase knowledge of the biological and genetic basis of the disease should be given priority.

Venus Express meets its target

The European Space Agency's (ESA) Venus Express probe has successfully gone into orbit around its target – the Earth's "sister planet" Venus – after a five month journey of 415 million km. The probe was tracked right up to the point where it met the Venutian atmosphere and began a 50-minute engine burn to slow the probe and successfully place it into position in the Venutian atmosphere.

Women in Science

When one considers women in science, very few have reached the heights achieved by Susan Greenfield – Director of the Royal Institution of Great Britain, Fullerian Professor of Physiology at Oxford, Baroness, and recipient of the French Legion d'Honneur, which is of course precisely the problem. She has seen no evidence so far of beneficial outcomes for women in science trickling down from the EU to UK grassroots. However, there is a new EU funded initiative to bring together the many existing organisations and networks in Europe under a single European Platform of Women Scientists (EPWS). If the voices of women scientists are to be heard at European level, these networks need to work together, and to put forward their needs and observations in a succinct and co-ordinated fashion. According to Professor Greenfield, we will only know when real progress is being made "when young women choose not to give up on science – that's the goal."

Innovative Medicines

The chairman of R&D at GlaxoSmithKline (GSK), Dr Tachi Yamada, has spoken of the company's commitment to the EU's technology platform and Joint Technology

Initiative schemes, and his hope is that clinical trials will not be affected by the recent drug trials tragedy in the United Kingdom. Some 1400 drugs have been approved in the last 25 years and that 10 times that number have been tested in phase 1 studies. Referring to a recent incident in the UK in which six men suffered multiple organ failure when participating in a trial, Dr Yamada said: "This is the first time that this has ever happened, and it is my guess that it wouldn't happen again in another 25 years. There is always a risk, but we take huge precautions."

Seventh Framework Programme (FP7) Budget

Although the final figure for the FP7 budget is yet to be agreed it will include an extra €300 million. The total extra therefore going to research and education, including FP7 funding is €2100 million over the 2007 to 2014 timeframe. However, Members of the European Parliament (MEPs) were quick to express disappointment at the low level of funding for research

Research Funding by Charitable Foundations

The contribution of charitable foundations and other non-profit organisations to funding R&D in Europe could be significantly increased by sharing experiences and co-operating at a European level, which currently remains very low. This is unlike the US where the non-profit sector accounted for almost €13000 million (or 4.5%) of overall investment in R&D in 2003. The UK is a notable exception where the donation culture is well developed and organisations such as the Wellcome Trust and Cancer Research UK invest significant amounts. The Commission has established an expert group to produce a report on *The role of foundations and the non-profit sector in boosting R&D investment*, which was published in September 2005. The Commissioner is supporting one of the recommendations of the report – the establishment of a European Forum of Research Foundations.

Information and Communications Technology (ICT)

It is essential that the share of the EU research budget devoted to ICT is not reduced further during negotiations on financial aspects according to Viviane Reding, Information Society and Media Commissioner. Those nations that master the development of ICT will be the best positioned to benefit from it in their economy and society.

European Union - Digest

The references are to the Official Journal of the European Communities (OJ), Adopted Legislation from the L Series (OJL) and Proposals and Opinions from the C Series (OJC).

Agriculture

Commission Regulation 780/2006: organic production of agricultural products – OJL137(p9)25.5.06
Commission Decisions:
2006/335: authorising Poland to prohibit use of 16 genetically modified varieties of maize – OJL124(p26)11.5.06
2006/338: authorising Poland to prohibit use of certain varieties of maize – OJL125(p31)12.5.06
Second call for Proposals: Community programme on genetic resources in agriculture – OJC102(p15)28.4.06

Animals and Veterinary Matters

Commission Regulations:
688/2006: monitoring of TSEs and specified risk material in Sweden – OJL120(p10)5.5.06
699/2006: access for poultry to open-air runs: OJL121(p36)6.5.06
773/2006: additives in feedingstuffs – OJL135(p3)23.5.06
776/2006: Community reference laboratories – OJL136(p3)24.5.06
Commission Decisions:
2006/266: protection measures in relation to avian influenza in Israel – OJ L96(p10)5.4.06
2006/268: bluetongue in Italy – OJL98(p75)6.4.06
2006/273: bluetongue in Spain – OJL99(p35)7.4.06
2006/274: swine fever in Germany – OJL99(p36)7.4.06
2006/277: protection measures in relation to avian influenza in wild birds in the Community – OJL103(p29)12.4.06
2006/282: programmes for the eradication and control of TSEs – OJL104(p40)13.4.06
2006/290: bovine TB and bovine leukosis: Italy and Slovakia – OJL106(p21)19.4.06
2006/293: avian influenza – OJL107(p44)20.4.06
2006/297: classical swine fever in Germany – OJL108(p31)21.4.06
2006/306: classical swine fever in Germany – OJL113(p6)27.4.06
2006/314: Member States' survey programme for avian influenza in 2006 – OJL116(p61)29.4.06
2006/321: avian flu in Romania, Turkey and Croatia – OJL118(p18)3.5.06
2006/327: classical swine fever in certain Member States – OJL120(p24)5.5.06
2006/328: classical swine fever in Germany – OJL120(p25)5.5.06
2006/346: classical swine fever in Germany – OJL128(p10)16.5.06

2006/354: Newcastle disease in Bulgaria – OJL132(p34)19.5.06
Opinion of the Economic and Social Committee: animal health requirements for aquaculture animals – OJC88(p13)11.4.06

Aviation

Council Directive 2006/23: Air traffic controller licence – OJL114(p22)27.4.06
Commission Regulations:
730/2006: airspace classification – OJL128(p3)16.5.06
736/2006: inspections by European Aviation Safety Agency – OJL129(p10)17.5.06
768/2006: information on the safety of aircraft – OJL134(p16)20.5.06

Chemicals

Commission Directive 2006/50: placing biocidal products on the market – OJL142(p6)30.5.06
Commission Regulations:
565/2006: testing and information requirements on certain priority substances – OJL99(p3)7.4.06
777/2006: export and import of dangerous chemicals – OJL136(p9)24.5.06
Commission Decisions:
2006/257: inventory and common nomenclature of ingredients used in cosmetic products – OJL97(p1)5.4.06
2006/275: occupational exposure to chemical agents – OJL101(p4)11.4.06
2006/347: cadmium in fertilisers: Sweden – OJL129(p19)17.5.06
2006/348: cadmium in fertilisers: Finland – OJL129(p25)17.5.06
2006/349: cadmium in fertilisers: Austria – OJL129(p31)17.5.06
2006/350: methyl bromide – OJL130(p29)18.5.06
Commission Communication on results of risk evaluation and reduction strategies for certain substances – OJC90(p4)13.4.06

Energy and Nuclear Industries

Council Directive 2006/32: Energy end-use efficiency and energy services – OJL114(p64)27.4.06
Opinions of the Economic and Social Committee:
Energy Efficiency – OJC88(p53)11.4.06
Regrowing raw materials – OJC110(p49)9.5.06
Wood as an energy source – OJC110(p60)9.5.06

Environment

Commission Regulation 605/2006: suspending introduction into the Community of specimens of certain wild flora and fauna – OJL107(p3)20.4.06
Call for proposals: Environmental Protection – corrigendum – OJC112(p13)12.5.06

Education and Training

Opinion of the Economic and Social Committee: transnational mobility for education and training – OJC88(p20)11.4.06

Fisheries

Council Regulations:
700/2006: fishing licences – OJL122(p1)9.5.06
764/2006: Fisheries Partnership Agreement with Morocco – OJL141(p1)29.5.06
Commission Regulations:
549/2006: prohibition of fishing for Northern prawn in certain waters – OJL96(p3)5.4.06
556/2006: prohibition of fishing for herring in certain waters by Polish vessels – OJL98(p63)6.4.06
614/2006: prohibition of fishing for black scabbardfish in certain waters by French vessels – OJL108(p3)21.4.06
636/2006: prohibition of fishing for herring by French vessels – OJL112(p10)26.4.06
742/2006: adapting certain fish quotas for 2006 – OJL130(p7)18.5.06
Opinion of the Economic and Social Committee: Community approach towards eco-labelling of fisheries products – OJC88(p27)11.4.06

Food

Commission Regulation 627/2006: analytical methods for sampling etc of primary smoke products – OJL109(p3)22.4.06
Commission Decision 2006/330: conditions and certificates for imports of meat products from third countries – OJL121(p43)6.5.06

IT, Telecommunications and Broadcasting

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Association of the British Pharmaceutical Industry



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The ABPI is the voice of the innovative pharmaceutical industry, working with Government, regulators and other stakeholders to promote a receptive environment for a strong and progressive industry in the UK, one capable of providing the best medicines to patients.

The ABPI's mission is to represent the pharmaceutical industry operating in the UK in a way that:

- assures patient access to the best available medicine;
- creates a favourable political and economic environment;
- encourages innovative research and development;
- avoids unfair commercial returns

Association of Marine Scientific Industries



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AMSI is a constituent association of the Society of Maritime Industries; the other associations are:

- Association of British Offshore Industries (ABOI)
- British Marine Equipment Association (BMEA)
- British Naval Equipment Association (BNEA)
- Ports and Terminals Group (PTG)

Academy of Medical Sciences



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The Academy of Medical Sciences promotes advances in medical science and campaigns to ensure these are converted as quickly as possible into healthcare benefits for society. The Academy's eight hundred Fellows are the United Kingdom's leading medical scientists from hospitals, academia, industry and the public service. The Academy provides independent, authoritative advice on public policy issues in medical science and healthcare.

AIRTO



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AIRTO represents the UK's independent research and technology sector - member organisations employ a combined staff of over 10,000 scientists and engineers with a turnover in the region of £1.5 billion. Work carried out by members includes research, consultancy, training and global information monitoring. AIRTO promotes their work by building closer links between members and industry, academia, UK government agencies and the European Union.

Biochemical Society



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The Biochemical Society exists to promote and support the Molecular and Cellular Biosciences. We have nearly 6000 members in the UK and abroad, mostly research bioscientists in Universities or in Industry. The Society is also a major scientific publisher. In addition, we promote Science Policy debate and provide resources, for teachers and pupils, to support the bioscience curriculum in schools. Our membership supports our mission by organizing scientific meetings, sustaining our publications through authorship and peer review and by supporting our educational and policy initiatives.

Biotechnology and Biological Sciences Research Council



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The BBSRC is the UK's leading funding agency for academic research in the non-medical life sciences and is funded principally through the Science Budget of the Office of Science and Innovation. It supports staff in universities and research institutes throughout the UK, and funds basic and strategic science in: agri-food, animal sciences, biomolecular sciences, biochemistry and cell biology, engineering and biological systems, genes and developmental biology, and plant and microbial sciences.

British Association for the Advancement of Science - the BA



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The BA is the UK's nationwide, open membership organisation dedicated to connecting people with science, so that science and its applications become accessible to all. The BA aims to promote openness about science in society and to engage and inspire people directly with science and technology and their implications.

Established in 1831, the BA organises major initiatives across the UK, including the annual BA Festival of Science, National Science Week, programmes of regional and local events, and an extensive programme for young people in schools and colleges.

British Ecological Society



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The British Ecological Society promotes the science of ecology worldwide. The Society has 4,000 members who are active in advancing the science and application of ecology.

The BES publishes four internationally renowned scientific journals and organises the largest scientific meeting for ecologists in Europe. The BES also supports ecologists in developing countries and fieldwork in schools through its grants.

The BES informs and advises Parliament and Government on ecological issues and welcomes requests for assistance from parliamentarians.

BRITISH PHARMACOLOGICAL SOCIETY



Today's science, tomorrow's medicines

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The British Pharmacological Society has now been supporting pharmacology and pharmacologists for 75 years. Our 2,400 members, from academia, industry and clinical practice, are trained to study drug action from the laboratory bench to the patient's bedside. Our aim is to improve the quality of life by developing new medicines to treat and prevent the diseases and conditions that affect millions of people and animals. Inquiries about drugs and how they work are welcome.

The British Psychological Society



The British Psychological Society

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The British Psychological Society is an organisation of over 42,000 members governed by Royal Charter. It maintains the Register of Chartered Psychologists, publishes books, 10 primary science Journals and organises conferences. Requests for information about psychology and psychologists from parliamentarians are welcome.

British Society for Antimicrobial Chemotherapy

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Founded in 1971, and with 800 members worldwide, the Society exists to facilitate the acquisition and dissemination of knowledge in the field of antimicrobial chemotherapy. The BSAC publishes the *Journal of Antimicrobial Chemotherapy* (JAC), internationally renowned for its scientific excellence, undertakes a range of educational activities, awards grants for research and has active relationships with its peer groups and government.

British Veterinary Association



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BVA's chief interests are:

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BVA carries out three main functions which are:

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CABI



www.cabi.org

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CABI brings together and applies scientific information and expertise to improve people's lives. Founded in 1910, CABI is owned by over 40 member countries. Today CABI publishes books, journals and scientific outputs, carries out scientific research and consultancies to find sustainable solutions to agricultural and environmental issues and develops innovative ways to communicate science to many different audiences. Activities range from assisting national policy makers, informing worldwide research, to supporting farmers in the field.

Campden & Chorleywood Food Research Association



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A independent, membership-based industrial research association providing substantial R&D, processing, analytical hygiene, best practice, training, auditing and HACCP services for the food chain worldwide. Members include growers, processors, retailers, caterers, distributors, machinery manufacturers, government departments and enforcement authorities. Employs over 300; serves over 2,000 member sites; and has a subsidiary company in Hungary. Activities focus on safety, quality, efficiency and innovation. Participates in DTI's Faraday Partnerships and collaborates with universities on LINK projects and studentships, transferring practical knowledge between industry and academia.

Cavendish Laboratory



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The Cavendish Laboratory houses the Department of Physics of the University of Cambridge.

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Centre for Environment, Fisheries & Aquaculture Science

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Engineering and Physical Sciences Research Council



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English Nature



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English Nature is the Government's wildlife agency working throughout England. With our partners and others we promote the conservation of wildlife and natural places.

We commission research and publish scientific papers which underpin the development of policies and programmes to maintain and enhance biodiversity

Environment Agency



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The Environment Agency is responsible for protecting and enhancing the environment in England and Wales. We contribute to sustainable development through the integrated management of air, land and water. We commission research to support our functions through our Science Programme that is based on a 5 year plan developed through consultation.

Freshwater Biological Association



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The Freshwater Biological Association is an independent organisation and a registered Charity, founded in 1929. It aims to promote freshwater science through an innovative research programme, an active membership organisation and by providing sound independent opinion. It publishes a variety of specialist volumes and houses one of the finest freshwater libraries in the world.

Health Protection Agency



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The Health Protection Agency is an independent organisation dedicated to protecting people's health in the United Kingdom. We do this by providing impartial advice and authoritative information on health protection uses to the public, to professionals and to government.

We combine public health and scientific expertise, research and emergency planning within one organisation. We work at international, national and regional and local levels and have many links with many other organisations around the world. This means we can respond quickly and effectively to new and existing national and global threats to health including infections, environmental hazards and emergencies.

Human Fertilisation and Embryology Authority



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The HFEA is a non-departmental Government body that regulates and inspects all UK clinics providing IVF, donor insemination or the storage of eggs, sperm or embryos. The HFEA also licenses and monitors all human embryo research being conducted in the UK.

Institute of Biology



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The biological sciences have truly come of age with the new millennium and the Institute of Biology is the professional body to represent biology and biologists to all. A source of independent advice to Government, a supporter of education, a measure of excellence and a disseminator of information - the Institute of Biology is the Voice of British Biology.

The Institute of Mathematics and its Applications



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The IMA is a professional and learned society for qualified and practising mathematicians. Its mission is to promote mathematics in industry, business, the public sector, education and research. Forty percent of members are employed in education (schools through to universities), and the other 60% work in commercial and governmental organisations. The Institute is incorporated by Royal Charter and has the right to award Chartered Mathematician status.

Institute of Physics

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The Institute of Physics supports the physics community and promotes physics to government, legislators and policy makers.

It is an international learned society and professional body with over 35,000 members worldwide, working in all branches of physics and a wide variety of jobs and professions - including fundamental research, technology-based industries, medicine, finance - and newer jobs such as computer games design. The Institute is active in school and higher education and awards professional qualifications. It provides policy advice and opportunities for public debate on areas of physics such as energy and climate change that affect us all.

Institute of Physics and Engineering in Medicine



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Website: www.ipem.ac.uk

IPEM is a registered, incorporated charity for the advancement, in the public interest, of physics and engineering applied to medicine and biology. It accredits medical physicists, clinical engineers and clinical technologists through its membership register, organises training and CPD for them, and provides opportunities for the dissemination of knowledge through publications and scientific meetings. IPEM is licensed by the Science Council to award CSci and by the Engineering Council (UK) to award CEng, IEng and EngTech.

IChem^E

Institution of Chemical Engineers

IChemE is the hub for chemical, biochemical and process engineering professionals worldwide. We are the heart of the process community, promoting competence and a commitment to sustainable development, advancing the discipline for the benefit of society and supporting the professional development of over 25,000 members.

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Institution of Civil Engineers ice

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Website: www.ice.org.uk

ICE aims to be a leader in shaping the engineering profession. With over 75,000 members, ICE acts as a knowledge exchange for all aspects of civil engineering. As a Learned Society, the Institution provides expertise, in the form of reports and comment, on a wide range of subjects from energy generation and supply, to sustainability and the environment.

Institution of Engineering and Technology IET



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Institution of Engineering and Technology
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Website: www.theiet.org

The Institution of Engineering and Technology was formed in 2006 by the Institution of Electrical Engineers and the Institution of Incorporated Engineers. The IET has more than 150,000 members worldwide who work in a range of industries. The Institution aims to lead in the advancement of engineering and technology by facilitating the exchange of knowledge and ideas at a local and global level and promoting best practice.

LGC

Queens Road, Teddington
Middlesex, TW11 0LY
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E-mail: info@lgc.co.uk
Website: www.lgc.co.uk



*Setting standards
in analytical science*

LGC, a science service company, is Europe's leading independent provider of analytical and diagnostic services and reference standards. LGC's market-led divisions - LGC Forensics, Food Chain and Environment, Life Sciences, Pharmaceutical and Chemical Services and LGC Promochem (for Reference Materials) - operate in a diverse range of sectors for both public and private sector customers.

Under arrangements for the office and function of Government Chemist, LGC fulfils specific statutory duties and provides advice for Government and the wider analytical community on the implications of analytical chemistry for matters of policy, standards and regulation.

LGC is based in Teddington, Middlesex, with other UK operations in Runcorn, Edinburgh, Culham, Risley and Tamworth and facilities in France, Germany, Italy, Poland, Spain, Sweden and India.

University of Leeds



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The University of Leeds is among the largest research universities in Europe. We have some 3000 researchers, including postgraduates, and an annual research income of more than £70m. Research activity extends across nine faculties representing most core disciplines and often crosses traditional subject boundaries. In the last Research Assessment Exercise, we had 35 schools rated internationally or nationally excellent.

London Metropolitan Polymer Centre



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Website: www.polymers.org.uk

The London Metropolitan Polymer Centre provides training, consultancy and applied research to the UK polymer (plastics & rubber) industry. The training courses are delivered through a programme of industrial short courses and customised courses and these, together with distance learning and other flexible delivery methods, lead to qualifications ranging from technician to Masters level. Recent successes include a WRAP sponsored programme to develop new commercial applications for recycled PET and several technology transfer projects with companies.

Marks & Spencer Plc

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Main Business Activities

Retailer – Clothing, Food, Financial Services and Home

We have over 400 stores in 31 territories worldwide, employing 65,000 people.

We offer our customers quality, value, service and trust in our brand by applying science and technology to develop innovative products and services.

Medical Research Council



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Website: www.mrc.ac.uk

The Medical Research Council (MRC) is funded by the UK taxpayer. We are independent of Government, but work closely with the Health Departments, the National Health Service and industry to ensure that the research we support takes account of the public's needs as well as being of excellent scientific quality. As a result, MRC-funded research has led to some of the most significant discoveries in medical science and benefited millions of people, both in the UK and worldwide.

MERCK SHARP & DOHME

Merck Sharp & Dohme Research Laboratories

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Merck Sharp & Dohme is a UK subsidiary of Merck & Co Inc a global research-driven pharmaceutical company dedicated to putting patients first. Merck discovers, develops, manufactures and markets vaccines and medicines in over 20 therapeutic categories directly and through its joint ventures. Our mission is to provide society with superior products and services by developing innovations and solutions that improve the quality of life.

The National Endowment for Science, Technology and the Arts



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NESTA aims to be the single most powerful catalyst for innovation in the UK. In everything it does, it is seeking to increase the UK's capacity to fulfil its vast innovative potential. Through a range of pioneering programmes, it invests at every stage of the innovation process; providing early stage seed capital for promising ideas for new products and services; investing in UK talent to ensure it stays in the UK; and experimenting with new ways of engaging the public in science, technology and the creative industries.

National Physical Laboratory



National Physical Laboratory
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Website: www.npl.co.uk

The National Physical Laboratory (NPL) is the United Kingdom's national standards laboratory, an internationally respected and independent centre of excellence in research, development and knowledge transfer in measurement and materials science. For more than a century, NPL has developed and maintained the nation's primary measurement standards - the heart of an infrastructure designed to ensure accuracy, consistency and innovation in physical measurement.

Natural Environment Research Council



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The UK's Natural Environment Research Council funds and carries out impartial scientific research in the sciences of the environment. NERC trains the next generation of independent environmental scientists.

NERC funds research in universities and in a network of its own centres, which include:

British Antarctic Survey, British Geological Survey, Centre for Ecology and Hydrology, National Oceanography Centre and Proudman Oceanographic Laboratory

University of Newcastle upon Tyne

UNIVERSITY OF NEWCASTLE



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The University of Newcastle upon Tyne is a member of the Russell Group of research intensive Universities. Newcastle has a considerable reputation in undertaking 'research with a purpose'. The University has a well balanced portfolio of research funding and has one of the highest levels of research projects funded by the UK Government Departments and a very significant portfolio of FP6 EU activity (with over 100 projects involving more than 1800 partners). The University is taking its commitment further through the development of Newcastle Science City.

The Nutrition Society



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Founded in 1941, The Nutrition Society is the premier scientific and professional body dedicated to advance the scientific study of nutrition and its application to the maintenance of human and animal health. Highly regarded by the scientific community, the Society is the largest learned society for nutrition in Europe. Membership is worldwide and is open to those with a genuine interest in the science of human or animal nutrition.

Principal activities include:

1. Publishing internationally renowned scientific learned journals
2. Promoting the education and training of nutritionists
3. Promoting the highest standards of professional competence and practice in nutrition
4. Disseminating scientific information through its publications and programme of scientific meetings

Particle Physics and Astronomy Research Council

PPARC

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The PPARC is the UK's strategic science investment agency that directs and funds research in national and international programmes in fundamental physics.

It is this research into fundamental physics that lies behind some of the major technological advances of the 20th Century, and delivers world leading science, technologies and people for the UK.

Prospect



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Prospect is an independent, thriving and forward-looking trade union with 102,000 members. We represent scientists, technologists and other professions in the civil service, research councils and private sector.

Prospect's collective voice champions the interests of the engineering and scientific community to key opinion-formers and policy makers and, with negotiating rights with over 300 employers, we seek to secure a better life at work by putting members' pay, conditions and careers first.



The Royal Academy of Engineering

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Founded in 1976, The Royal Academy of Engineering promotes the engineering and technological welfare of the country by facilitating the application of science. As a national academy, we offer independent and impartial advice to Government; work to secure the next generation of engineers; pursue excellence; and provide a voice for Britain's engineering community. Our Fellowship - comprising the UK's most eminent engineers - provides the leadership and expertise for our activities, which focus on the importance of engineering and technology to wealth creation and the quality of life.

Kew

PLANTS PEOPLE
POSSIBILITIES



KEW GARDENS

The mission of Kew is to enable better management of the Earth's environment by increasing knowledge and understanding of the plant and fungal kingdoms – the basis of life on Earth. Kew is fundamentally a scientific, amenity and educational organisation devoted to increasing knowledge and public understanding of plant and fungal diversity – how it came to be, what its current status is, how it can be conserved for future generations, and how it can be used in sustainable ways for human benefit.

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SAVING THE WORLD'S PLANTS FOR LIFE

The Royal Institution



The Royal Institution of Great Britain

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E-mail: ri@ri.ac.uk Website: www.rigb.org

The Royal Institution has a reputation established over 200 years for its high calibre events that break down the barriers between science and society. It acts as a unique forum for informing people about how science affects their daily lives, and prides itself on its reputation of engaging the public in scientific debate. During 2006 the Ri is closed for the refurbishment of its Grade 1 listed building. The public and schools' events programme will continue throughout this time. For more details on this and our refurbishment plans, please see our website.

The Royal Society



THE ROYAL SOCIETY

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Website: www.royalsoc.ac.uk

Founded in 1660, the Royal Society is an independent academy promoting the natural and applied sciences. It aims to:

- strengthen UK science by providing support to excellent individuals
- fund excellent research to push back the frontiers of knowledge
- attract and retain the best scientists
- ensure the UK engages with the best science around the world
- support science communication and education; and communicate and encourage dialogue with the public
- provide the best independent advice nationally and internationally
- promote scholarship and encourage research into the history of science

RSC Advancing the Chemical Sciences The Royal Society of Chemistry

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Website: http://www.rsc.org
http://www.chemsoc.org

The Royal Society of Chemistry is a learned, professional and scientific body of over 46,000 members with a duty under its Royal Charter "to serve the public interest". It is active in the areas of education and qualifications, science policy, publishing, Europe, information and internet services, media relations, public understanding of science, advice and assistance to Parliament and Government.

The Royal Statistical Society



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The RSS is much more than just a learned society. We lead the way as an independent source of advice on statistical issues and play a crucial role in raising the profile of statistics, through our links with government, academia and the corporate and voluntary sectors. We have a powerful voice at Royal Commissions, Parliamentary Select Committees and at public consultations, offering our own unique view on just about anything, from freedom of information to sustainable development.

The Science Council

the SCIENCE council

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The Science Council has a membership of over 27 professional institutions and learned societies covering the breadth of science and mathematics. Its purpose is to provide an independent collective voice for science and scientists and to maintain standards across all scientific disciplines. We are active in science policy issues including science in education, health, society and sustainability. In 2003 the Science Council was granted its Royal Charter and in 2004 it launched the Chartered Scientist (CSci) designation as a measure of high standards in the practice, application, advancement and teaching of science. We now have over 10,000 Chartered Scientists.



Technology Skills For Productivity & Performance

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SEMATA (Science, Engineering and Manufacturing Technologies Alliance) is the Sector Skills Council for the science, engineering and manufacturing technology sectors.

Our **Mission** is 'to ensure that our sector has the knowledge and skills required to meet the challenges faced by the workforce of the future.'

Our sectors account for a significant proportion of the UK economy. There are about 2 million people employed in about 76,000 establishments in the core Science, Engineering and Technology sectors, currently contributes over £74 billion per annum – about ten per cent – of total UK GDP.

society for general Microbiology

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SGM is the largest microbiological society in Europe. The Society publishes four journals of international standing, and organises regular scientific meetings.

SGM also promotes education and careers in microbiology, and it is committed to represent microbiology to government, the media and the public.

An information service on microbiological issues concerning aspects of medicine, agriculture, food safety, biotechnology and the environment is available on request.

Society of Chemical Industry



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SCI is an interdisciplinary network for science, commerce and industry. SCI attracts forward-looking people in process and materials technologies and in the biotechnology, energy, water, agriculture, food, pharmaceuticals, construction, and environmental protection sectors worldwide. Members exchange ideas and gain new perspectives on markets, technologies, strategies and people, through electronic and physical specialist conferences and debates, and publish journals, books and the respected magazine *Chemistry & Industry*.

Society of Cosmetic Scientists



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Advancing the science of cosmetics is the primary objective of the SCS. Cosmetic science covers a wide range of disciplines from organic and physical chemistry to biology and photo-biology, dermatology, microbiology, physical sciences and psychology.

Members are scientists and the SCS helps them progress their careers and the science of cosmetics ethically and responsibly. Services include publications, educational courses and scientific meetings.

University of Surrey



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The University of Surrey is one of the UK's leading professional, scientific and technological universities with a world class research profile and a reputation for excellence in teaching and learning. Ground-breaking research at the University is bringing direct benefit to all spheres of life - helping industry to maintain its competitive edge and creating improvements in the areas of health, medicine, space science, the environment, communications, ion beam and optoelectronics technology, visual multi media, defence and social policy.

Universities Federation for Animal Welfare



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Registered Charity No: 207996

UFAW is an internationally-recognized independent scientific and educational animal welfare charity. It works to improve animal lives by:

- supporting animal welfare research.
- educating and raising awareness of welfare issues in the UK and overseas.
- producing the leading journal *Animal Welfare* and other high-quality publications on animal care and welfare.
- providing expert advice to government departments and other concerned bodies.

Science Diary

The Parliamentary and Scientific Committee

Contact: Annabel Lloyd
020 7222 7085
www.scienceinparliament.org.uk

Tuesday 17 October 10.00-14.30
Visit to Imperial College

Monday 23 October 17.30
Marine Science
Speakers to be confirmed

Monday 23 November 17.30
Patient Safety
Speakers to be confirmed

Tuesday 28 November 10.00-14.30
Visit to NPL

Monday 4 December 17.30
Materials
Speakers to be confirmed

The Royal Institution

Due to refurbishment, all Ri events are to be held at external venues throughout 2006. See www.rigb.org or telephone 020 7409 2992 for full details and to book tickets..

Tuesday 18 July 19.00
From bad to worse: the worst ideas on the mind

Prof Edgar Jones, Dr Joanna Moncrieff, Richard Webster and Prof Simon Wessely
King's College London

Wednesday 9 August 10.00-12.30
Mathematics Masterclasses
Prof Chris Budd, Prof Alan Davies, Dr Colin Wright or Prof Sir Christopher Zeeman
The Institute of Education

Thursday 28 September 19.00
Imagine: Healthier by design
Prof Roger Coleman, Colum Lowe and Henry Marsh
Royal College of Art, London

Wednesday 11 October
How can technology meet the needs of an ageing population?
Various speakers
Techniquet, Cardiff

Thursday 12 October 18.00
Confronting the Goldilocks enigma: why is the universe so uncannily fit for life?
Prof Bernard Carr, Prof Paul Davies, Prof Michael Duff and Revd Dr Rodney Holder
Imperial College London

Wednesday 18 October 19.00
Science Graduate of the Year
Alex Mischenko
Gresham College

Thursday 19 October 18.30
The best science books ever
Various speakers
Imperial College London

Wednesday 25 October 19.00
Something in the genes: Walter Rothschild, zoological collector extraordinaire
Victor Gray
The Royal College of Surgeons of England

The Royal Society

6-9 Carlton House Terrace
London SW1Y 5AG
The Royal Society runs a series of events, both evening lectures and two day discussion meetings, on topics covering the whole breadth of science, engineering and technology. All the events are free to attend and open to all. Please see www.royalsoc.ac.uk/events for the full events programme, more details about the events below and web casts of past events.

Tuesday 12, Wednesday 13 & Thursday 14 September 10.00-18.30
Royal Society Glasgow Science Exhibition
A showcase of some of the best science in the UK and an opportunity to talk to the scientists doing the research.
Glasgow Science Centre.

Monday 18, Tuesday 19 & Wednesday 20 September
Recent developments in the study of Gamma-ray bursts

The Royal Academy of Engineering

29 Great Peter Street,
London SW1P 3LW.
For further information visit www.raeng.org.uk/events or contact events@raeng.org.uk

Friday 8 September
A Balanced Approach to Energy – The Nordic Experience
7 Carlton House Terrace, London SW1
For further details contact: Amy Abbott
Email: amy.abbott@raeng.org.uk

Wednesday 13 – Friday 15 September
UK Focus for Biomedical Engineering Musculo-Skeletal Mechanics
Durham University
This event will be held for invited young researchers.
For further details contact: Brian Doble
Email: brian.doble@raeng.org.uk

Tuesday 3 October
Hinton Lecture
IET, Savoy Place, London WC2R
For further details contact: Amy Abbott
Email: amy.abbott@raeng.org.uk

The Royal Society of Edinburgh

22-26 George Street,
Edinburgh EH2 2PQ.

Tel: 0131 240 5000

Fax: 0131 240 5024

events@royalsoced.org.uk

www.royalsoced.org.uk

All events require registration and take place at the RSE.

Monday 4 September 17.30

Extreme Fluid Dynamics and the Search for a New Engineering Science

Professor Jason Reese FRSE

Wednesday 27 September 18.00

Earth, Wind, Fire and Water: Earthquakes

Discussion Forum

The BA (British Association for the Advancement of Science)

Saturday 2 – Saturday 9 September

BA Festival of Science, Norwich

For further information visit

www.the-ba.net/festivalofscience

SCI

14/15 Belgrave Square

London SW1X 8PS

Contact: conferences@soci.org or 020 7598 1562

Unless otherwise stated events are at SCI

Monday 18 & Tuesday 19 September
A Celebration of Organic Chemistry
Novartis, Horsham

Wednesday 11 October

The Role of Polymers in Drug Delivery

Wednesday 25 October

Introduction to ADMET: Solving problems chemically

Thursday 26 October

Bitumen Demystified

Monday 30 October

Toxicogenomics - Its role in Health Assessment and Environmental safety



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SCIENCE IN PARLIAMENT

Published by the Parliamentary and Scientific Committee, 3 Birdcage Walk, London SW1H 9JJ.

Published four times a year. The 2006 subscription rate is £65.00. Single numbers £16.25

ISSN 0263-6271

All enquiries, including those from members wishing to take the front or back covers, advertise in the journal or appear in the directory to Mrs Annabel Lloyd, Tel 020 7222 7085

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Promoting Britain's Younger Scientists, Engineers and Technologists at the House of Commons



Presentations at
House of Commons
by Britain's Top
Younger Scientists,
Engineers and Technologists

SET for

BRITAIN

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